APPENDIX C

Draft County Surface Runoff Plans

San Francisco Bay Area Environmental Management Plan

March 1978

This plan was prepared by the Association of Bay Area Governments with a grant and other assistance from the Environmental Protection Agency, in cooperation with Bay Area Air Pollution Control District, Metropolitan Transportation Commission, San Francisco Bay Regional Water Quality Control Board and Counties of the Bay Area with assistance of these agencies: ■ Army Corps of Engineers ■ California Air Resources Board ■ California Department of Health ■ California Department of Transportation ■ Council of Bay Area Resource Conservation Districts ■ Governor's Office of Planning and Research ■ Lawrence Berkeley Laboratory ■ Lawrence Livermore Laboratory ■ San Francisco Bay Conservation and Development Commission ■ State Water Resources Control Board ■ State Solid Waste Management Board ■ Wastewater Solids Study

ABAG

INTRODUCTION

This appendix contains the county Surface Runoff Management Plans. A regional summary precedes the individual county plans. This summary, with the exception of a few minor modifications, is identical to Surface Runoff Brief No. 3, presented to the Environmental Management Task Force (EMTF) on November 2, 1977.

CONTENTS

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CONTENTS

ENVIRONMENTAL
MANAGEMENT **PLAN**

San Francisco Bay Region

REGIONAL SUMMARY
OF THE DRAFT COUNTY SURFACE RUNOFF MANAGEMENT PLANS

November 1977

ASSOCIATION OF BAY AREA GOVERNMENTS ABAG

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

Figures

Tables

INTRODUCTION

This regional summary of the county surface runoff management plans was prepared as the third brief to EMTF. The first brief, presented to EMTF on February 9, 1977, described the goals and organization of the Surface Runoff Management Program. It also included program progress and products during the first six months of the work. EMTF adopted the technical approach outlined in the first brief.

The second brief to EMTF (June 22, 1977) presented the known and potential water quality problems related to and/or resulting from surface runoff. The brief, which reflected work done by staffs of the participating Bay Area Counties and ABAG, was limited to problem idientification based on three data sources; (1) surveys by counties and previous reports, (2) sampling of storm runoff in the not-so-wet season of 1976-77, and (3) mathematical modeling of surface runoff water quality and quantity. Based on this brief, EMTF concluded that the nature of the problem is such that pollution from surface runoff cannot be ignored, but the current knowledge about the problem will not justify costly controls. As a result, in its action of June 29, 1977, EMTF called for development of a surface runoff plan which will be a reasonable initial step towards the reduction of pollution problems caused by surface runoff, i.e., not costly to implement, reflect local problem difinition, and provide for further problem identification.

This summary was prepared by ABAG staff under the direction of Yoram J. Litwin and B.J. Miller. The following individuals participated in the preparation of the brief: Steven J. Goldman, Joseph Eilers, Norma Weisner, Bruce Fitting, and Fredrick Wolin. The brief is based on information contained in individual county draft Surface Runoff Control Plans. At the time of brief preparation not all county plans were finalized.

DRAFT OF THE REGIONAL SURFACE RUNOFF MANAGEMENT PLAN

A. PURPOSE OF THE REGIONAL PLAN

Twelve draft management plans have been prepared as part of the Environmental Management Program (EMP) for the San Francisco Bay Region. These are:

- Air quality maintenance plan
- Water quality management plan
- Eight county-wide surface runoff control plans
- Water conservation, reuse and supply management plan
- Solid waste management plan

The eight county surface runoff control plans constitute the largest single element of the EMP. They are closely interrelated through the commonality of (1) water quality problems in the local streams and reservoirs, (2) the considered mitigation practices, and (3) the mutually shared concern for pollution of San Francisco Bay.

The purpose of the Regional Surface Runoff Management Plan is to put in a regional perspective the local pollution problems and the recommended actions of the eight individual county plans. To complete the regional perspective a brief reference is also made to the surface runoff aspects of the San Francisco Wastewater Management Plan (developed prior to EMP).

channels or reservoirs. The underlying principle during plan development was that although more data is needed, the available information on problems and effectiveness of control measures is sufficient to justify the following actions:

- Ones with obvious water quality benefits
- Ones with water quality benefits and other benefits
- Ones directed toward developing more information
- Ones with water quality benefits that can be easily incorporated in current or future practices.

3. Problem Summary

Seven major surface runoff problems have been identified. They are discussed in more detail in Section D. The main types of problems are as follows:

- Sedimentation and Erosion
- Bacterial Contamination
- Heavy Metals, Pesticides and Other Toxic Compounds
- Oil and Grease
- Litter and Debris
- Nutrients and Algae Growth
- Organic Wastes and Low Dissolved Oxygen

In general, the problems may increase in the future, with increases in development, if no actions are taken.

4. Control Measures Summary

The plan recommendations include a variety of control measures. Table 1 provides an overall summary, of which control measures are included in each county plan. A more detailed examination of these control measures is provided in Section E.

Seventeen major types of control measures are in Table 1. They range from improving street sweeping practices to developing public education programs. Within these seventeen types there are 112 specific recommendations. The control measures reduce surface runoff pollution by at least one of four methods: (1) reduce accumulation of pollutants prior to runoff (2) reduce the peak flow or volume of runoff (3) control land use in sensitive areas, and (4) treat and store runoff.

TABLE -7

REGIONWIDE SUMMARY OF CONTROL MEASURES IN COUNTY SURFACE RUNOFF PLANS

(IN ADDITION TO EXISTING PRACTICES)

	ALAMEDA	CONTRA COSTA	MARIN	NAPA	SAN MATEO	SANTA CLARA	SOLANO	SONOMA
Improve street sweeping	●	●	●	●	●	●	●	●
Control use of certain chemicals	●					●	●	
Clean stormwater collection system			●		●		●	●
Control littering	●		●		●			●
Control dumping	●	●		●	●	●	●	
Repair streets		●		●				
Insure proper operation of septic tanks							●	
Control erosion	●	●	●	●	●	●	●	●
Improve agricultural practices			●	●		●	●	●
Divert runoff from contaminated areas	●		●				●	●
Treat and store runoff				●		●		●
Control land use	●		●			●	●	
Establish water quality monitoring program	●	●	●	●	●	●	●	●
Establish a public education/information program	●	●	●	●	●	●	●	●
Establish a Surface Runoff administrative structure and/or procedures for continuing planning	●	●	●	●	●	●	●	●

Several control measures are common to all or nearly all the plans. All eight plans contain recommendations regarding:

- controlling erosion
- establishing public education/information programs
- improving street sweeping practices

Six county plans contain recommendations for:

- establishing water quality monitoring program
- cleaning the stormwater collection systems
- controlling dumping of pollutants

Other control measures that are mentioned by several county plans include:

- documenting existing problems and ensuring that all activities comply with the plan
- establishing of county coordination and advisory committees in the continuing planning process
- insuring proper operation of septic tanks
- constructing facilities to treat and store runoff
- conducting demonstration projects

The control measures shown in Table 1 are in addition to existing practices. Some counties already have extensive programs. As a result, a control measure proposed in one county's plan may be an existing practice in another county.

In addition to control measures to be carried out locally, the plan identifies the following actions that can be best implemented at the regional level, principally by ABAG:

- Continued Management of the Surface Runoff Program
- Coordination of Data Gathering
- Technical Information Exchange
- Preparation of Model Ordinances
- Educational Programs
- Providing Regional Environmental Perspective on State Legislation.

TABLE 7

REGIONWIDE SUMMARY OF CONTROL MEASURES IN COUNTY SURFACE RUNOFF PLANS

(IN ADDITION TO EXISTING PRACTICES)

	ALAMEDA	CONTRA COSTA	MARIN	NAPA	SAN MATEO	SANTA CLARA	SOLANO	SONOMA
Improve street sweeping	●	●	●	●	●	●	●	●
Control use of certain chemicals	●					●	●	
Clean stormwater collection system			●		●		●	●
Control littering	●		●		●			●
Control dumping	●	●		●	●	●	●	
Repair streets		●		●				
Insure proper operation of septic tanks							●	
Control erosion	●	●	●	●	●	●	●	●
Improve agricultural practices			●	●		●	●	●
Divert runoff from contaminated areas	●		●				●	●
Treat and store runoff				●		●		●
Control land use	●		●			●	●	
Establish water quality monitoring program	●	●	●	●	●	●	●	●
Establish a public education/information program	●	●	●	●	●	●	●	●
Establish a Surface Runoff administrative structure and/or procedures for continuing planning	●	●	●	●	●	●	●	●

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5. Plan Implementation and Enforcement

The county plans are based largely on existing practices. Therefore, the agencies already performing such duties can implement the plan. These agencies are for the most part at the local government level and include several city and county departments. County plans also provide for agencies to update and continue the planning. In addition, ABAG has been named to continue its initial planning functions and oversee local surface runoff efforts.

Financing of plan implementation is to be paid for mostly out of local funds. The county plans are relatively inexpensive during the initial stages of implementation, and local sources of money will for the most part be sufficient to cover anticipated costs. Outside sources of funds i.e., those from State and Federal agencies will be used only for higher cost capital items such as vacuum sweepers for cleaning streets.

Compliance with the plan will essentially be voluntary for the first two years following EPA approval of the initial plan. If any local government is not undertaking its assigned responsibilities, the county lead agency will discuss the matter with the jurisdiction. All instances of compliance and non-compliance will be noted by ABAG (for plan update purposes) and the San Francisco Bay Regional Water Quality Control Board (for possible future sanctions). At the end of the two-year period the Regional Board, headed by the State Water Resources Control Board and EPA may elect to enforce the surface runoff plan. It currently has such authority under State and Federal law. Such enforcement may not be necessary, however, if local jurisdictions make satisfactory progress in plan implementation.

6. Multiple Benefits

The Surface Runoff Management Plan will result in several benefits in addition to water quality improvement. The four major categories include:

- aesthetics and recreation
- flood control and water supply
- soil conservation
- mosquito abatement

A complete discussion of benefits other than water quality is provided in Section F on costs, benefits and effects of the Plan.

C. BACKGROUND

1. Goals and Objectives

The goal of the Surface Runoff Management Plan is the same as the goal for the entire EMP, namely to produce a plan with the following characteristics:

- o It will lead to the greatest practicable improvement in water quality, and problems caused by solid wastes, and will lead to compliance with Federal and State standards and objectives at the earliest possible date.

- o It will not have social, economic or environmental effects so unacceptable as to prevent implementation.

Reaching this goal will also be a reasonable initial step towards compliance with the Federal Water Pollution Act Amendments of 1972 which states as follows:

> "The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act--
>
> 1) it is the national goal that the discharge of pollutants into the navigable water be eliminated by 1985;
>
> 2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and procreation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;
>
> 3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;"

Specific goals and objectives included in the individual county plans are cited in Table 2.

2. Legal Mandates and Governmental Policies Related to Surface Runoff

The Surface Runoff Management Plan is consistent with the following State and Federal laws:

- o *Federal Water Pollution Control Act (FWPCA):* Amendments of 1972 (Section 208, Public Law 92-500) Section 208 of this Act requires that water quality management plans be prepared which shall include measures to identify and control pollution from nonpoint sources. The intent of the law is to eliminate pollutant discharge and to make all waters swimmable and fishable. Development of the Environmental Management Plan was funded in part through this Act.

TABLE 2 SPECIFIC GOALS AND OBJECTIVES IN THE INDIVIDUAL

COUNTY SURFACE RUNOFF CONTROL PLANS

NO.	Specific Objectives of County Plans	ALAMEDA	CONTRA COSTA	MARIN	NAPA	SAN MATEO	SANTA CLARA	SOLANO	SONOMA
1	To insure the quality of streams lakes and the Bay are not degraded.	0	●	0	●	0	0	●	0
2	To determine the nature and magnitude of surface runoff problems and to develop a data base in support of plan development and its continued updating.	●	●	●	●	●	●	●	0
3	To develop locally a set of recommended actions which will adequately mitigate identified problems, with sufficient flexibility to allow for necessary refinements as more data becomes available.	●	0	●	●	●	●	●	●
4	To assess the identified actions according to the principle of Best Management Practices, practicality, social-economic acceptability and their cost effectiveness and multiple-purpose benefits.	0	●	●	0	0	0	0	0
5	To realize the maximum feasible maintenance and/or improvement of existing practices to significantly reduce the quantity of surface runoff pollutants entering the receiving waters	●	●	●	●	●	0	●	●
6	Utilize the existing agencies to implement the plan or, of needed, develop feasible financial institutional implementation methods and procedures.	●	0	●	0	●	0	●	●
7	Develop phased implementation which will include a combination of: (1) actions that are ongoing programs (2) additional actions for near term implementation and (3) the cintinuing planning process.	●	●	●	0	●	0	●	●
8	Provide maximum opportunity for the general public and local public agencies to participate in decisions regarding initial plan recommendations and the continuing planning process.	●	●	●	●	●	0	●	●

Note: ● = stated objectives

o = implied objectives

- *Porter-Cologne Water Quality Control Act:* The Porter-Cologne Act is a State law which provides the State Water Quality Control Board with authority to control water pollution in the State. The San Francisco Bay Regional Water Quality Control Board, acting for the State, has the authority to impose fines and sanctions on persons who unintentionally or negligently permit wastes to be discharged to create a pollution problem.

- *California Environmental Quality Act (CEQA):* This Act requires that all actions with potential for impacting on the environment be assessed in terms of costs/benefits, alternatives to the proposed action and long/short-term effects, and mitigation measures for adverse environmental impacts.

- *Refuse Act of 1899 (Rivers and Harbors Act):* The original intent of this Federal Act was to prevent dumping of materials into navigable waters that would cause hazards for ship traffic. This Act was later interpreted to include control of pollutant discharge into navigable water. Although much of the usefulness of the Act for controlling pollution was greatly diminished with passage of the 1972 Amendments to the FWPCA, it still may be invoked for situations not addressed in the FWPCA. Responsibility for ensuring that the Act is enforced rests with the U.S. Army Corps of Engineers.

3. Previous and Concurrent Planning and Programs

Programs considered as part of the Surface Runoff Management Plan (such as channel and storm drain cleaning, street sweeping, and maintenance, or erosion control) are not new and are individually carried out for various purposes by various organizations. The difference in the 208 program is that it stresses a comprehensive planning approach by local governments with an integrated focus on the nonpoint pollution problems. Such an approach is new and cannot be equated with any other previous or concurrent planning or programs.

It is nevertheless appropriate to refer to a number of programs or plans that proved to be helpful to the development of county surface runoff control plans:

- *Past Studies and Reports:* About two hundred various studies, reports, EIR's, and EIS's were cited in the individual county plans. They cover a broad range of topics related to local surface runoff; flood control, water supply, drainage, erosion and sediment control, soil surveys, etc.

- *Basin Plan:* In 1975 the San Francisco Bay Basin Plan, authorized under Section 303 of Water Pollution Control Act Amendments of 1972, was completed by the Regional Water Quality Control Board. The work was done by a consortium of consultants. The Basin Plan identified surface runoff as the remaining significant source of water pollution in the Bay Area.

- *Urban Studies Program:* The Urban Studies Program is a joint planning effort initiated in 1972 by the U.S. Army Corps of Engineers in conjunction with Federal, State and local governmental agencies. As part of this program the San Francisco District is conducting an Areawide Water Quality Management Study for Upper Alameda Creek, which has been incorporated into Alameda County Surface Runoff Control Plan. The objective of this study is to provide a management plan compatible with non-point source control goals and comprehensive development goals of the Bay Area.

- *Clean Lakes Program:* The Clean Lakes Program was initiated Nationwide in 1975 by the Environmental Protection Agency in an effort to prevent pollution and provide for restoration of fresh water lakes. Three lake renewal projects in the Bay Area are currently being funded under this program (Lakes Temescal, Lafayette and Stafford).

- *California Coastal Plan:* The California Coastal Plan was prepared by the California Coastal Zone Conservation Commission in 1975. Some of the findings of the Commission are as follows: surface runoff can degrade coastal waters; coastal streams are vital to the natural system of the coast and human activities on land introduces nonpoint source pollutants which damage stream habitats. The two coastal counties, Marin and San Mateo are interfacing their plans with their counties' respective plans for the coastal zone.

4. How the Plan Was Prepared

In developing the plan ABAG's policy was to involve the broadest possible participation from cities, counties and regional agencies. As a result, the development of the Surface Runoff Management Plan was a complex process involving:

- Eight Bay Area Counties (Planning, Public Works or Flood Control Departments)

- Five Engineering Consulting Firms (some providing assistance directly to the counties, other through a contract to ABAG)

- Three Federal Organizations (EPA, Army Corps of Engineers, and U.S. Geological Survey)

- Three State Organizations (State Water Resources Control Board, CALTRANS, and Department of Forestry)

- Four Regional Agencies (Regional Water Quality Control Board, East Bay MUD, San Francisco Bay Area Conservation and Development Commission, and Area Council of Resources Conservation Districts)

- Large number of Special Interest Representation including local industry, public interest groups, environmental interest groups, etc.

Figure 1 displays the details of plan development process. The main steps in plan preparation included:

- Water quality sampling program
- Mathematical modeling of surface runoff and nonpoint pollutants
- Countywide survey of water quality problems and causes
- Countywide survey of existing practices
- Formulation of control measure alternatives
- Assessment and institutional-financial analysis of the proposed control measures

In the course of plan development, the Environmental Management Task Force has given policy guidance. Work progress has been reviewed and commented upon by the Surface Runoff Technical Advisory Committee which includes representatives from public agencies, private industry, special interest groups and concerned citizens. In addition the staff progress of individual counties was reviewed by the County Advisory Committees which, in addition to the public and private interest groups, include strong representation of the local cities and agencies.

The Surface Runoff Management Plan has already undergone a rather extensive intra-county review process. Its approval will be done as part of the overall EMP. The major elements of the review and approval process are also shown in Figure 1. An interesting feature shown in Figure 1 is that initial implementation of some of the county plans' recommendation will start at the local level prior to final plan approval and acceptance by the EPA Regional Administrator.

SURFACE RUNOFF MANAGEMENT PLAN

PLAN DEVELOPMENT AND APPROVAL PROCESS

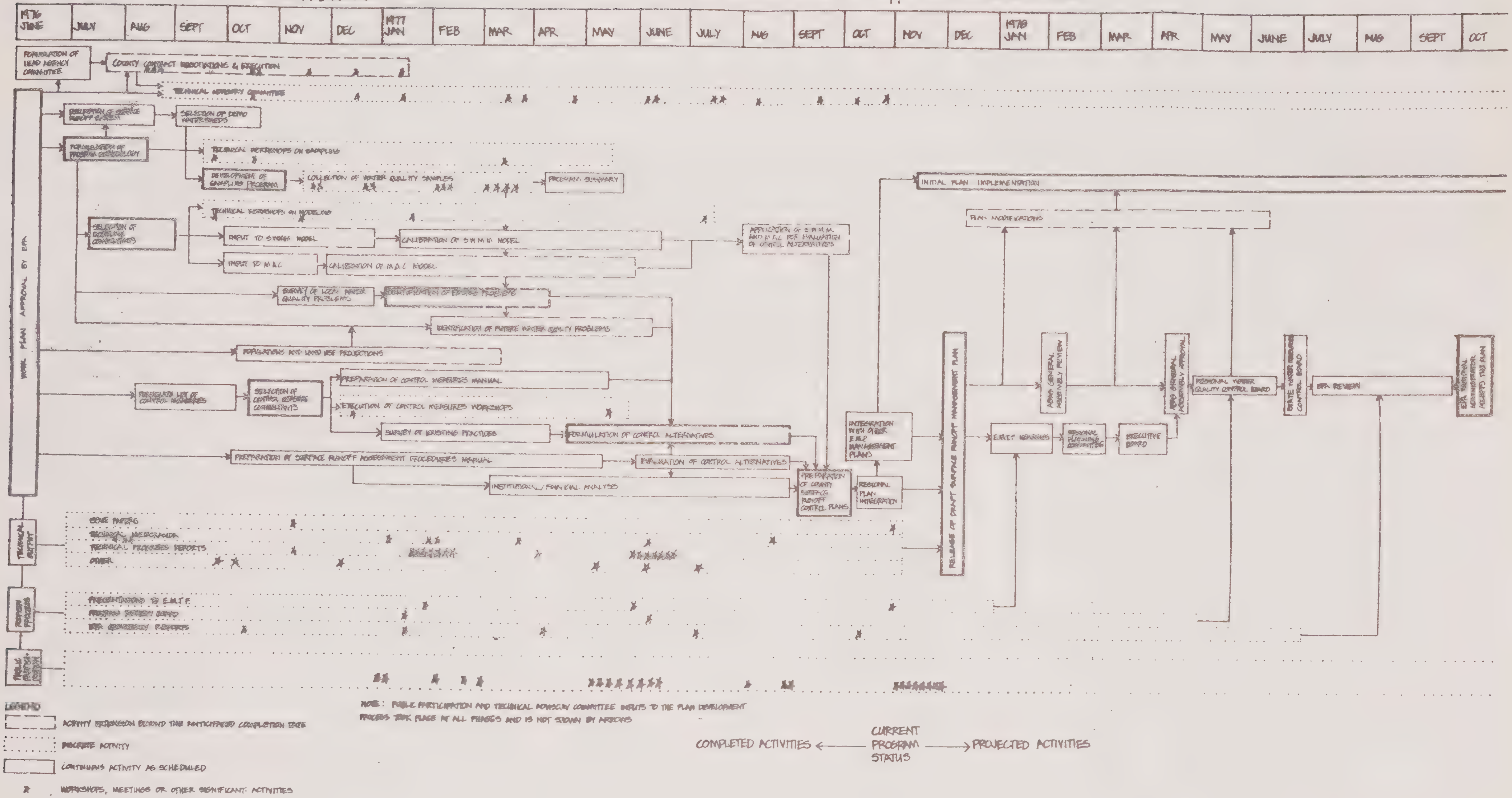


Figure - 1
SURFACE RUNOFF MANAGEMENT PLAN
PLAN DEVELOPMENT AND APPROVAL PROCESS

D. THE SURFACE RUNOFF PROBLEMS ADDRESSED BY THE PLAN

1. The Nature of Surface Runoff Problems

As rain falls on the land and flows to the streams, lakes and the Bay, it picks up the material from the surfaces it flows across. The materials incorporated into surface runoff depend on the type of surface and the use of the land. In cities, large areas are covered by asphalt and concrete, preventing percolation of the rain into the soil. Litter, animal wastes, soil particles, oil and grease, plant material and various chemicals are flushed from the urban area by the water flowing over the surface. In open areas the rain and flowing water erode exposed soil and carry this along with plant matter and animal wastes into the water bodies. A simplified representation of the surface runoff problem is presented in Figure 2.

Three reasons account for not adequately addressing the surface runoff problem until now:

- Until recently, most efforts for controlling pollution have focused on point sources such as sewage treatment plants and industrial discharges. The point sources are easily recognizable factors in water pollution problems. As the point sources are gradually controlled in the Bay Area, an increasing portion of the overall problem is attributable to surface runoff.

- The amount of pollution from surface runoff is technically very difficult to determine; it is dispersed in both time and space and therefore data collection is far more costly and difficult than for point sources.

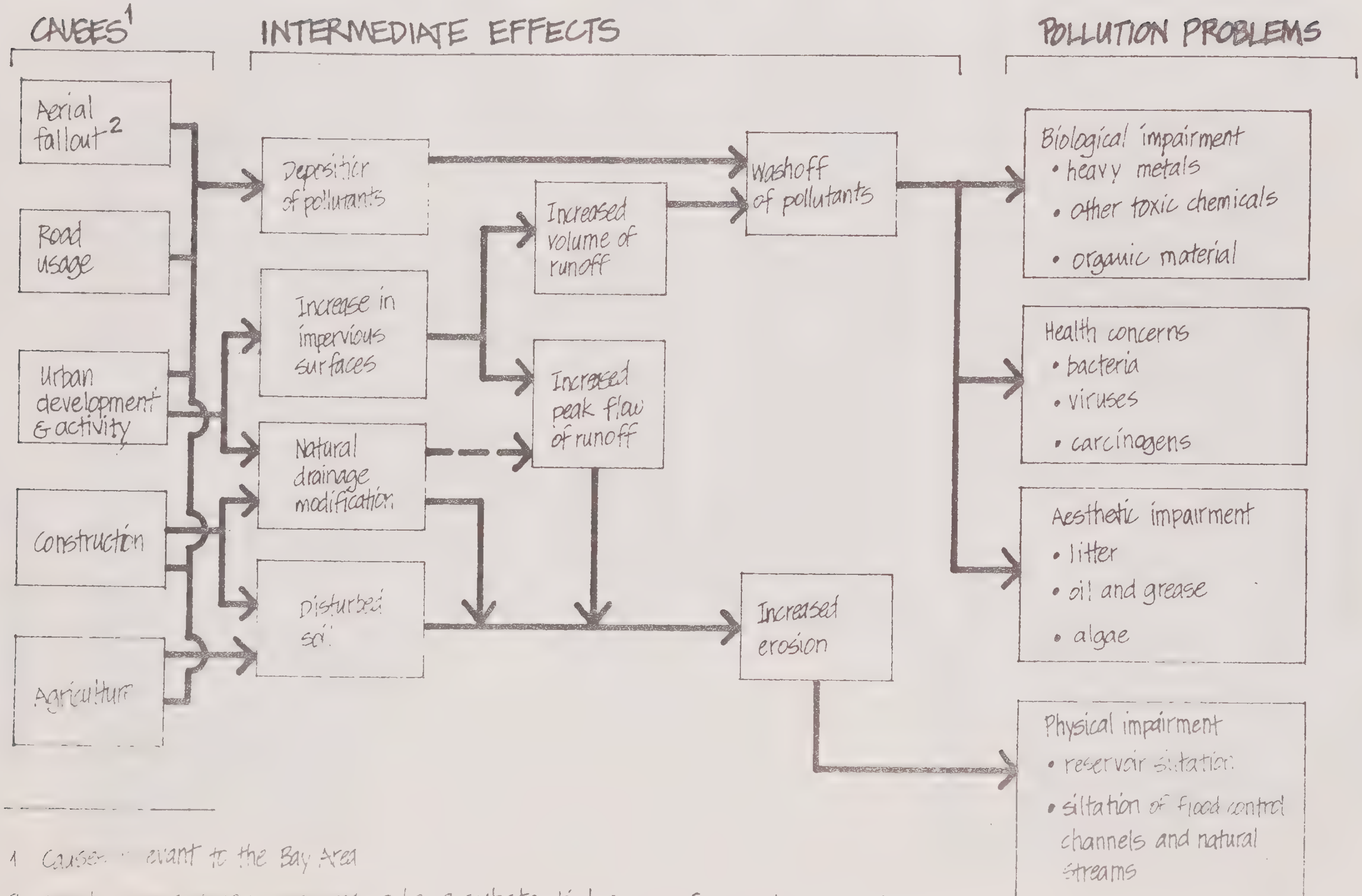
- It is not always evident what constitutes a surface runoff problem. Unlike the point sources, no precise standards are available for surface runoff. This increases the difficulty in problem identification.

A closely related reason for not adequately addressing the surface runoff problem is the question of public perception of water quality. Over the past two decades, a significant improvement in the quality of Bay waters took place. The problems today are no longer those of widespread odor or of imminent health hazards. They are more subtle and represent a second generation of pollutants. Included in this category are carcinogenic materials, heavy metals, and other toxic substances. The effects of such substances are visible to the public through numerous warning signs regarding shellfish harvesting or water contact sports. It appears that people have become used to such signs, and have not perceived the problems as high priority items.

2. Regionwide Overview

The surface runoff problem in the San Francisco Bay Area can best be described as persistent or chronic rather than critical. The persistence of the problem is equalled by its widespread distribution. The specific problems identified in the county surface runoff management plans are summarized in Table 3. As with other aspects of the surface runoff management plan, problem identification will be modified based on future information.

Figure - 2 THE SURFACE RUNOFF PROBLEM



1 Causes relevant to the Bay Area

2 Aerial fallout is not considered to be a substantial source for most pollutants.

TABLE 3

SURFACE RUNOFF PROBLEMS REPORTED IN COUNTY PLANS

An "X" opposite a problem indicates that a problem exists. No attempt has been made to rank the severity of the problems. An "X" absent from a column does not necessarily mean that the particular problem is not found within that county.

PROBLEM	EFFECT	EXAMPLES	CO's WITH REPORTED PROBLEM								CAUSE
			Ala	CC	Mar	Nap	SM	SC	Sol	Son	
SILTATION/ EROSION	Makes water more turbid. Covers fish spawning beds. Generally clogs streams. Reduces reservoir capacity.	Lake Temescal, Ala. Co. Permanante & Adobe Cr., S.C. Co., Channels in Pacifica.	X	X	X	X	X	X	X	X	Improper construction or agricultural practices. Any practice which exposes bare soil to rain & runoff or any soil to excessive runoff.
GREASE & OIL	Unsightly. Coats birds & aquatic life. Makes recreational use undesirable. Toxic to aquatic life.	Suisun Bay, Sol. CO., unnamed channel in Richmond. Streams & sloughs Milpitas, Sunnyvale & other S.C. Co. cities.	X	X			X	X	X		Industrial activity. Traffic. Dumping of motor oil & other floating substances.
DEBRIS & LITTER	Unsightly. Coats birds & aquatic life. Makes recreational use undesirable.	Tidal flats around bay. Streams in So. S.C. Co. Most cities in Ala. Co.	X	X	X	X	X	X	X	X	Improper dumping & refuse disposal & general littering where material can be washed off.
BACTERIAL CONTAMINATION	Indicative of presence of fecal material. Contact/ingestion can cause disease. Contaminates aquatic life in specific areas, especially shellfish. Eliminates recreational uses depending on level of contamination.	Suisun Bay, Sol. Co. Lake Merritt & Lake Temescal, Ala. Co. Various streams in So. S.C. Co. Bolinas Lagoon & Richardson Bay, Marin Co. Certain shell fish beds in S.M. Co.	X	X	X	X	X	X	X	X	Deposit of animal fecal material in areas subject to runoff. Cross connections with sanitary sewers. Malfunctioning septic tanks.
NUTRIENTS/ ALGAE GROWTH	Algae can cause taste & odors in drinking water. Can result in low concentrations of dissolved oxygen. Some is good; too much is bad. Hard to control once started in relatively confined water.	Napa R; Milliken, Rector & Bell Canyon Res. & Lake Hennessey in Napa Co. Lower Sonoma Cr., Suisun & Honkers Bay, Sol. Co. Bolinas Lagoon, Marin Co. Sloughs in S.C. Co. Lagoons in S.M. Co.	X		X	X	X	X	X	X	From natural organic material, fertilizers, industrial runoff, traffic.
HEAVY METALS PESTICIDES & OTHER TOXIC CHEMICALS	Toxic to aquatic life. Tendency to magnify in food chain, i.e. lower forms have relatively low concentrations in body tissue, higher forms (fish & aquatic birds) have high concentrations.	Mercury in Almaden & Calero Res. & downtown creeks in S.C. Co. Suisun & Grizzly Bays in Sol. Co.	X		X		X	X	X		Automobile operation, runoff from industrial areas. Runoff from refuse and garbage. Leaching of mine tailings.
ORGANIC WASTES/LOW DISSOLVED OXYGEN	Dissolved oxygen essential to most desirable forms of aquatic life.	Napa R., Lower Sonoma Cr., Suisun Slough in Sol. Co. Lower Petaluma R. in Son. Co., sloughs in S.C. Co.			X	X		X	X	X	Addition of organic material (eaten by bacteria in water, bacteria use dissolved oxygen in process) organic material from soil/plant origin or from traffic or industrial activities.

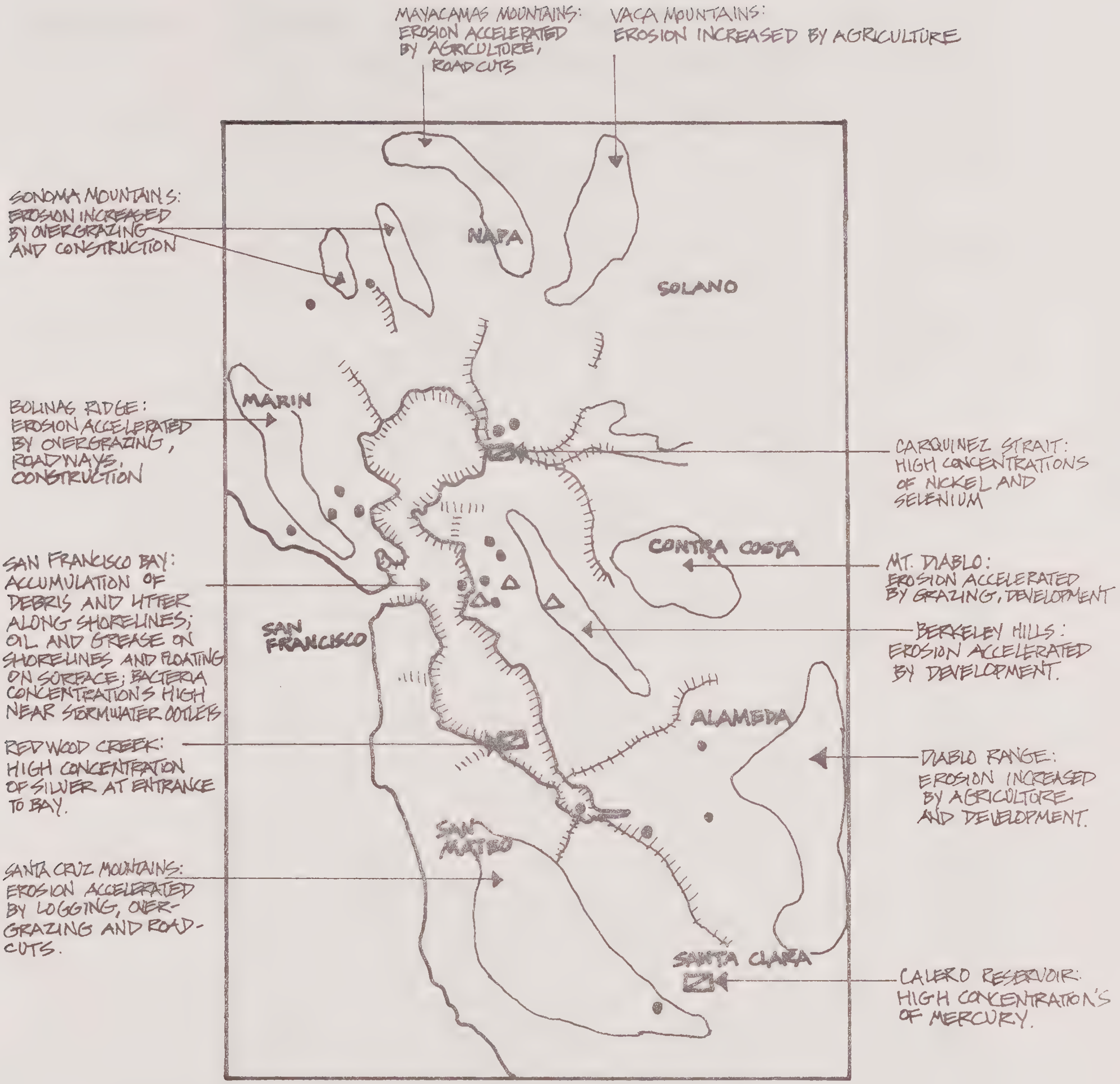
Figure 3 shows the location of problems, primarily caused by surface runoff. In some cases the surface runoff problems are significant. In most cases, however, the problems are moderate or slight. Some reservoirs are filling with sediment. Bacterial contamination, partly from surface runoff, causes closing of surface waters to swimming and harvesting of shellfish. Oil, litter and debris accumulate on the water and shorelines transforming scenic areas into unsightly ones. Another source of water pollution occurs when sewer systems overflow, allowing the untreated sewage to pass into the water. Septic fields malfunction, also allowing improperly treated sewage to be washed into streams.

In addition to these evident water pollution problems, a new area of environmental concern is growing. A number of dangerous chemicals are being detected in Bay Area waters. Although the evidence is not yet conclusive, there is reason to believe that some of these substances are present in surface runoff. These chemicals include heavy metals, pesticides and other synthetic organic compounds. Clearly, these toxic materials should not be ignored.

3. Discussion of the Identified Problems

- *Sedimentation and Erosion:* All counties in the Bay Area exhibit some signs of sedimentation and/or erosion. The problem is occurring in both the urban and rural areas. In the cities, major sources are construction sites and exposed stream channels. Major sources of sediment in the rural areas are overgrazed lands, tilled hillsides and erosion from roadside slopes. Also contributing to erosion problems are off-road recreation vehicles and "ranchettes" near streams. Sedimentation results in clogging of storm sewers and stream channels. High sediment loads make the water less fit for many human needs and increase the cost of treating water for consumption. High sediment loads can also damage freshwater organisms. The most apparent indication of the sedimentation problem can be found in Bay Area lakes and reservoirs. Of the sixty-nine lakes surveyed in the study area, seventeen were found to have sedimentation problems. An estimated cost of dredging to remove sediment from Bay Area reservoirs is from four to ten million dollars each year.

- *Bacterial Contamination:* Disease-causing bacteria are another major surface runoff pollutant identified by all counties. Numerous locations in the Bay Area have been posted by county health departments warning the public about health hazards from polluted water. The fecal bacterial count in surface runoff lies somewhere between that found in raw and treated sewage. As an example, Figure 4 shows the bacterial quality of surface runoff compared to raw sewage and the water quality objective for coliform bacteria. Many streams in the Bay Area have bacterial counts exceeding water quality standards during and following storms. During storm runoff, disease-causing bacteria enter the Bay. In shellfish beds exposed to runoff, bacteria accumulate in shellfish, making them unsafe for human consumption.



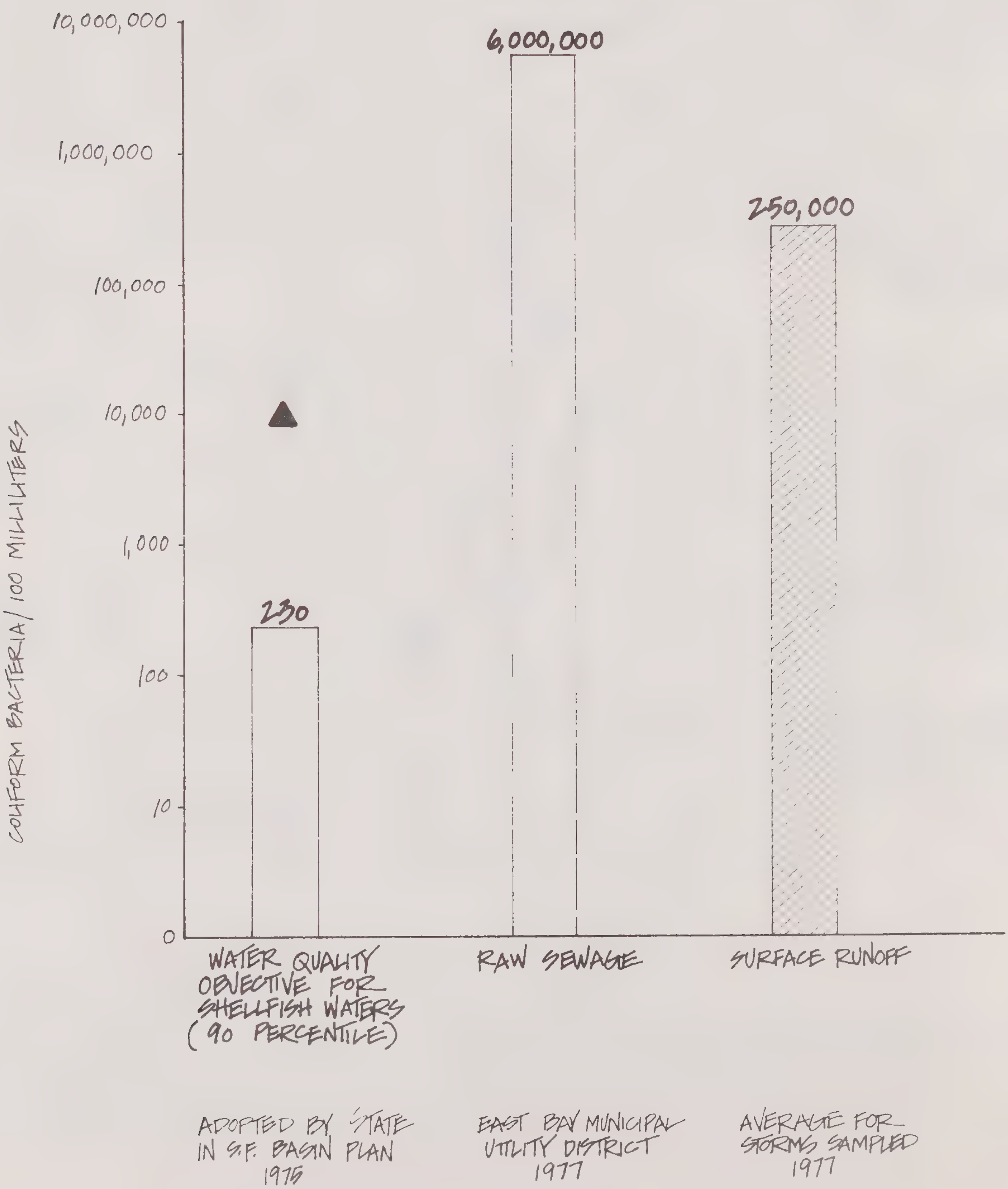
LEGEND:
- MAJOR AREAS OF EROSION
- HEAVY METALS/TOXICANTS
- ORGANIC WASTES/LOW DISSOLVED OXYGEN
- NUTRIENTS/ALGAE
- DEBRIS & LITTER/OIL & GREASE/BACTERIA

FIGURE 3. NON POINT SOURCE POLLUTION PROBLEMS IN THE SAN FRANCISCO BAY AREA

NOTE: THE PROBLEM AREAS ON THE MAP REPRESENT DOCUMENTED WATER QUALITY PROBLEMS. NOT ALL PROBLEMS ARE SHOWN, HOWEVER. NONPOINT POLLUTION PROBLEMS ARE DISPERSED IN TIME AND SPACE ~~AND ARE~~ DIFFICULT TO REPRESENT ON A SMALL SCALE MAP.

FIGURE 4

COLIFORM BACTERIA IN SURFACE RUNOFF COMPARED TO RAW SEWAGE—CASTRO VALLEY CREEK, HAYWARD, CALIFORNIA



▲ NO SAMPLE TO EXCEED THIS VALUE AT ANYTIME FOR RECREATIONAL WATERS.

In the rural areas, human fecal contamination occurs when septic tank leach fields do not operate properly. The improperly treated wastes either rise to the surface and are carried into the streams or enter the groundwater. Domestic animal wastes are the other major source of rural bacterial contamination. In the cities, the major sources are overflows from sewers and excrement from pets.

- *Heavy Metals, Pesticides and Other Toxic Compounds:* A large variety of complex and potentially dangerous chemicals are used in great quantities. Heavy metals such as lead, mercury and zinc are deposited on impervious surfaces from many routine activities, including automobile operation and industrial activities. Long-lasting pesticides are used in both agricultural and domestic operations. The use of other toxic substances such as synthetic organic compounds is widespread. Substantial quantities of these materials might be present in surface runoff.

  These substances, found in surface runoff, can kill or injure aquatic organisms. Some of these chemicals are known to induce cancerous growths. However, it is still not certain to what extent these effects are occurring in the natural environment. Past experience would suggest that the more that is learned about these substances the more likely it is that they will be regarded as serious problems.

- *Oil and Grease:* The problem from oil and grease in surface runoff generally appears in the metropolitan areas throughout the region. The major sources of oil in surface runoff are believed to be illegal disposal of used automobile crankcase oil, automobile operation and industrial activities. Oily sheen on the surface water is recognized as undesirable from a recreational standpoint and is a violation of State water quality objectives. Oil and grease can cause harm to aquatic and bird life by coating their bodies or by ingestion. While the occurrence of oil and grease in surface runoff does not have the same shock impact as an oil tanker spill, it is no less significant. The annual amount of oil and grease discharged into the Bay with surface runoff is estimated to be of the same magnitude as the amount of oil released from the 1971 Standard Oil tanker collision in San Francisco Bay (840,000 gallons).

- *Litter and Debris:* Litter and debris in our waterways has only one source--the careless and thoughtless disposal of solid wastes. Surface runoff transports much of this material to our lakes and to the Bay, where it often collects on the shores. If left in stream channels, the debris may accumulate, reducing the capacity of the channel to carry floodwaters. Perhaps the greatest impact of litter on Bay Area waters is in reducing aesthetic enjoyment.

- *Nutrients and Algae Growth:* Surface runoff waters carry both dissolved and particulate forms of plant nutrients. The nutrients most commonly considered as limiting to plant growth are nitrogen and phosphorus. While the Bay is a natural estuarine system which depends on these nutrients for its productivity, some lakes in the region have large populations of algae, partially as a result of overstimulation by excessive amounts of nutrients. The high densities of algae and larger aquatic plants impair water contact recreation and create taste and odor problems in water supply reservoirs. Major sources of nutrients in surface runoff are fertilizers, animal wastes, automobile operation and soil particles. Present levels of nutrient loadings in surface runoff are not regarded as a serious problem in the region. (See Figure 5b.)

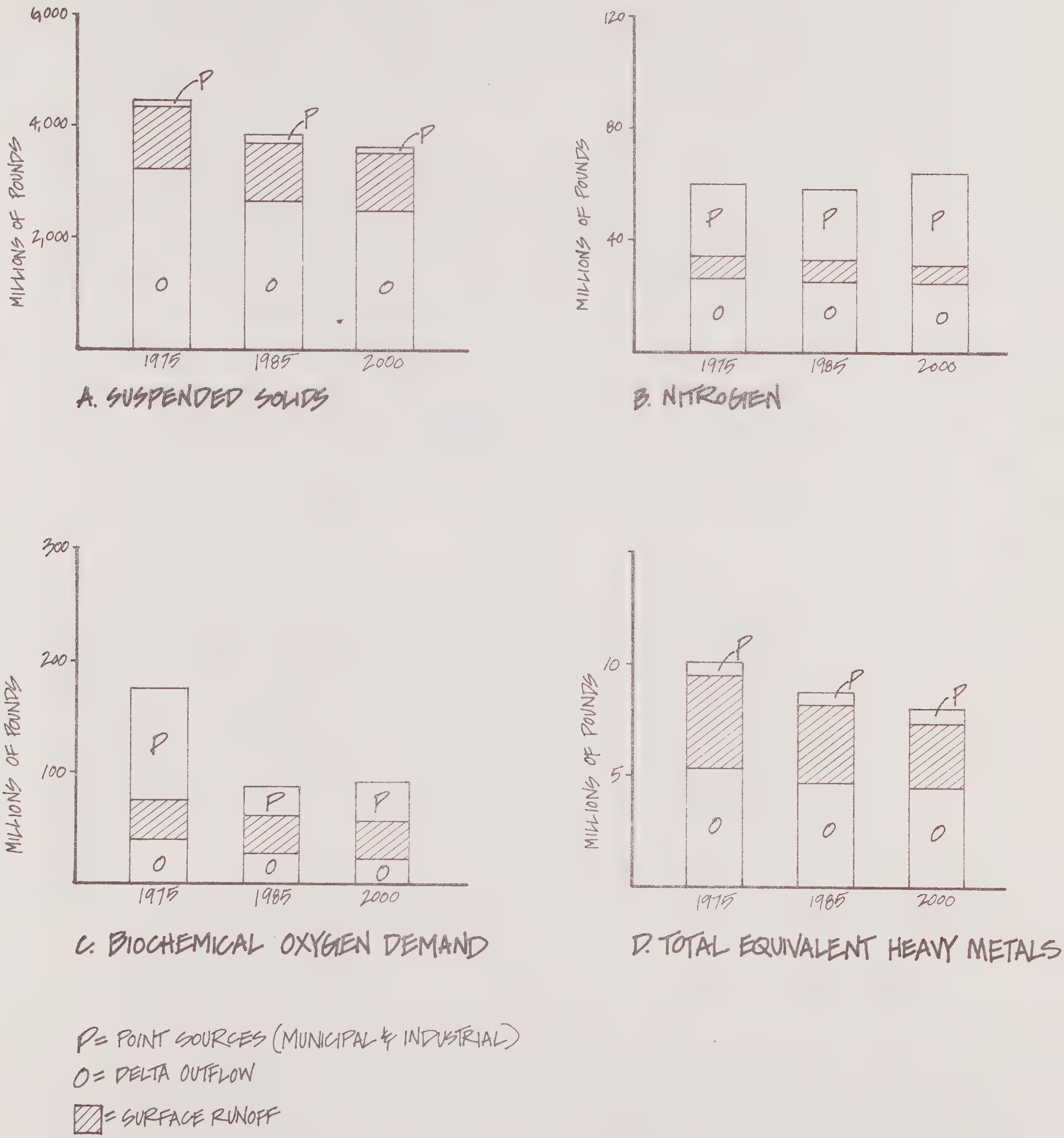
- *Organic Wastes and Low Dissolved Oxygen:* Organic pollutants consist primarily of animal excrement and decaying plant and animal material. During decomposition of these materials in water oxygen is consumed. If the amount of organic matter exceeds the capacity of the receiving water to assimilate the material, the oxygen in the water may be depleted. Fish and other organisms which require a certain amount of oxygen are either driven from the area or are killed. Some shallow protected areas of the Bay and local streams and reservoirs experience periodic oxygen depletions.

4. Comparison of Surface Runoff Problems with Other Pollution Sources

The significance of pollution from surface runoff can be assessed by comparing it with point source pollution, delta outflow and with surface runoff from undisturbed watersheds. The overall impact of the pollutant load to the Bay is presented in the Water Quality Management Plan. The significance of surface runoff during the six-month rainy season is discussed below. Compared to point sources and delta outflow, surface runoff is a substantial source of suspended solids, bacteria, toxic chemicals and litter. The reliability of information leading to this conclusion is verified by national data and historical information gathered in the Bay Area.

- *Surface Runoff Compared to Point Sources:* As shown in Figure 5a, d, surface runoff contributes far more heavy metals and suspended solids than point sources. The present contribution of organic material and nutrients is small. However, by 1985 the improvement in Bay Area sewage treatment will result in surface runoff pollution from organic wastes equalling that from point sources. Three additional categories of pollutants, bacteria, oil and litter, can only be approximated because of the difficulty in quantifying these materials. While more oil and grease is estimated to originate from point sources, it is believed that most of the bacteria and litter originate from surface runoff.

FIGURE 5
COMPARISON OF SURFACE RUNOFF, POINT SOURCES & DELTA OUTFLOW DURING THE RAINY SEASON



An important factor to note in comparing point sources and surface runoff is that point sources discharge primarily to the Bay while surface runoff discharges to both the Bay and the fresh water bodies in the region. Therefore materials which may appear harmless when diluted in a large system such as the Bay, may cause pollution problems in the smaller freshwater bodies.

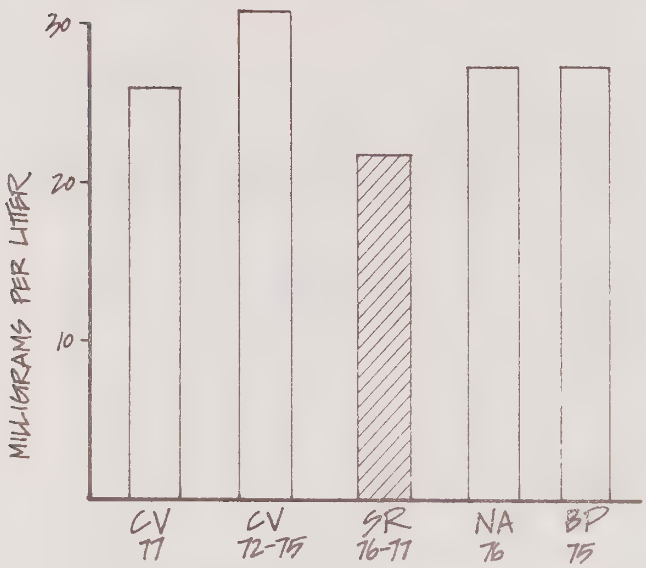
- *Surface Runoff Compared to Delta Outflow:* The volume of surface runoff water contributes approximately 13% of the fresh water input to the Bay compared to delta outflow during an average rainy season. Despite the relatively small percentage of the volume of water, surface runoff accounts for approximately 30% of the suspended solids, and 50% of the heavy metals. Bacteria, oil and litter are difficult to quantify but to a large extent they are believed to be transported by surface runoff.

- *Surface Runoff Compared with Nationwide Results:* Surface runoff data collected throughout the region indicates that the quality of runoff in the urban areas is similar to that found in other major metropolitan areas (Figure 6). The 600 stormwater samples collected and analyzed during the 1976-77 rainy season demonstrated that in urbanized areas, the surface runoff had high concentrations of suspended solids, bacteria, organic wastes, nutrients and toxic chemicals.

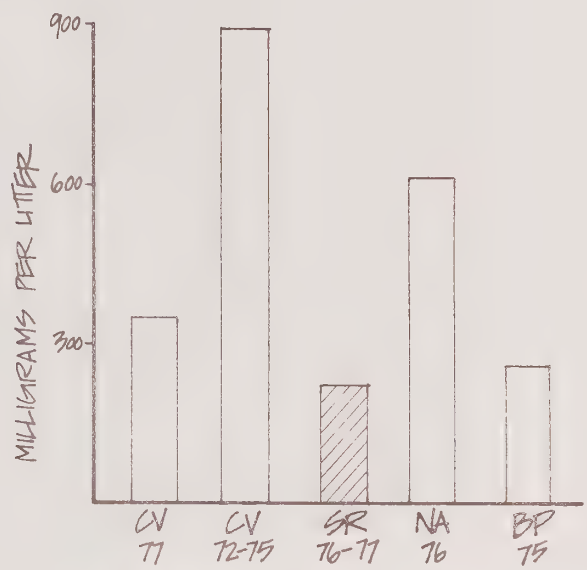
- *Surface Runoff in Periods of Drought Compared to Normal Rainfall Years:* The lack of normal rainfall during the 1976-77 surface runoff data collection period raised concerns that the drought may have affected the data. Surface runoff collected this past year in urban areas was compared with surface runoff data collected in the Bay Area from previous years (Figure 6). With the exception of suspended solids which is related to stream flow, no major difference in the two sets of data was detected. The drought did reduce the amount of runoff in rural areas substantially. Data collection in rural areas will resume with the return of more normal rainfall.

FIGURE 6

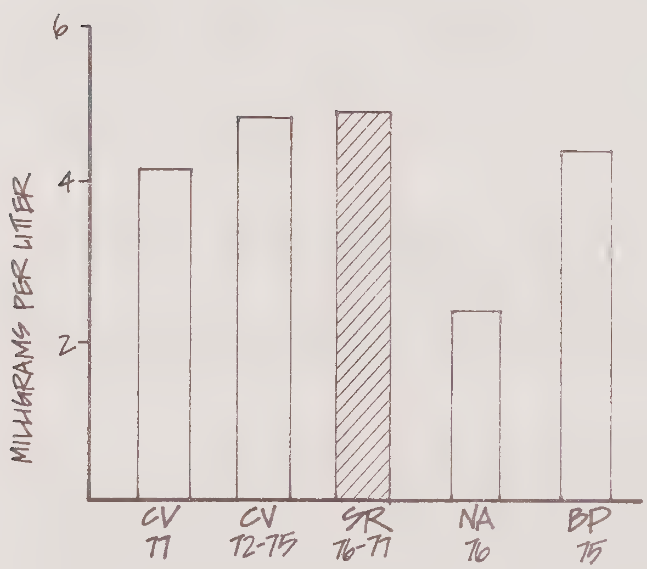
COMPARISON OF RECENT LOCAL DATA WITH NATIONAL AND PAST SURFACE RUNOFF DATA



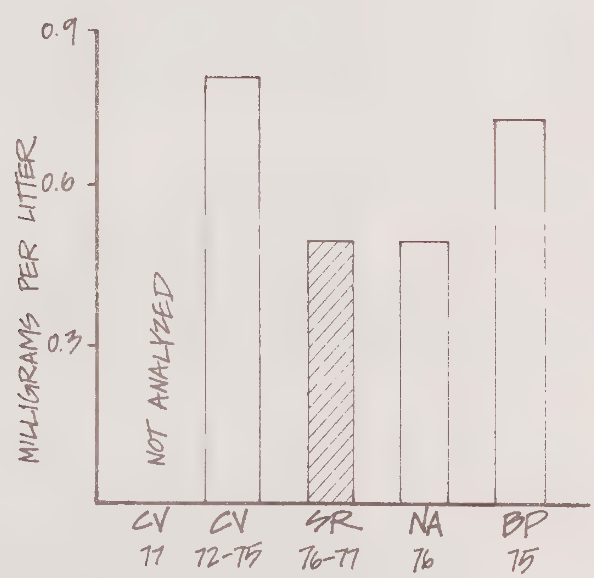
A. BIOCHEMICAL OXYGEN DEMAND



B. SUSPENDED SOLIDS



C. TOTAL NITROGEN



D. TOTAL PHOSPHORUS

1. CV 77 = CASTRO VALLEY (HAYWARD), 1977. SURFACE RUNOFF DATA COLLECTED BY ALAMEDA COUNTY.
   CV 72-75 = CASTRO VALLEY, 1972-1975. SURFACE RUNOFF DATA COLLECTED BY U.S. GEOLOGICAL SURVEY
   SR 76-77 = AVERAGE OF URBAN SURFACE RUNOFF DATA, 1976-77, COLLECTED BY COUNTIES & ABAG
   NA 76 = NATIONAL AVERAGE STORM WATER CONCENTRATIONS FROM SEPARATELY SEWERED CITIES, EPA 1976
   BP 75 = AVERAGE URBAN STORM WATER CONCENTRATIONS USED IN S.F. BASIN PLAN, 1975

E. THE PLAN

1. Planning Area

The planning area for the Surface Runoff Management Plan is the same as for the Water Quality and Water Supply, Conservation and Reuse Management Plans. The planning area for the remaining two management plans, the Air Quality Maintenance Plan and the Solid Waste Management Plan have slightly different planning areas.

The planning area is shown in Figure 3. In most cases the counties prepared their surface runoff control plans for the entire area of the county with the following two exceptions:

- The northern portions of Sonoma and Solano counties and the northeastern portion of Napa County are not included in the planning area.

- The plan for San Francisco was developed earlier and independently of EMP as part of the San Francisco Master Plan for Waste Water Management.

2. Brief Summaries of Individual County Plans

County Surface Runoff Management Plans will be included in their entirety in Volume V of EMP. The following summaries provide the essence of what control measures the counties propose to implement, particularly during the initial implementation phase. Included here is also a brief summary for San Francisco County.

Alameda

The intent of Alameda County's plan is to organize the collective efforts within the county to reach balanced solutions to its pollution problem. Surface water quality investigations conducted by the county since 1972 and the recent 208 investigations of urban stormwater runoff have verified the existence of substantial and widespread pollution of local interior waters.

To establish a process to manage these sources, recommended Best Management Practices (BMP's, i.e., non-structural source control measures) include: education programs, street cleaning, drainage system cleaning, litter and oil control and revisions of existing erosion control ordinances. In general, these BMP's are existing activities augmented by improvement of existing hygiene services. On agricultural lands, additional investigations with the agriculture agencies are recommended (by the Corps of Engineers) to develop land management plans to investigate erosion problems.

Documentation of existing service levels indicates that surface runoff control expenditures annually exceed \$4.7 million. Indications suggest that there is an interrelation between expenditure levels and effectiveness of surface runoff controls. It must be noted that these existing

service levels are in jeopardy of cutbacks due to budget pressures on property tax revenues. However, the maintenance of existing service levels or even existing budget levels is strongly recommended.

Contra Costa

Recognizing the many projects, programs, ordinances and regulations in effect which may be better designed to protect the quality of surface waters and protect the capacity of reservoirs in the county, the purpose of the control measures selected for additional implementation is to incorporate water quality considerations into the decision-making process to a greater extent than in the past. This will be accomplished by inclusion of water quality considerations in environmental impact review processes, design review guidelines and conditions of approval for construction projects, and as a guideline for selection of alternative plans for flood control and drainage work, road design, and other public projects, including maintenance programs. This will result in a higher level of awareness of the water quality implications of governmental actions. The need for public awareness will be met through a region-wide public education program.

Marin

Marin County is recognizing the already high level of effort expended by the cities, special districts and County of Marin relative to surface runoff pollution control. Therefore, the recommendations of the Marin County Surface Runoff Management Plan for initial implementation are directed more towards bringing about a uniformity in application and increased efficiency for existing measures rather than creating new programs to deal with specific problems. To these ends, the Marin County SRMP recommends:

1. The continuation and possible improvement of existing drainage system cleaning programs

2. The concentration of street sweeping efforts in highly contaminated areas and the establishment of sweeper schedule related parking restrictions

3. Greater emphasis on compliance with and enforcement of erosion control requirements at construction sites

In addition, the Plan recommends certain preventive measures such as a public information program and the adoption of strict runoff standards for all new developments within domestic water supply watersheds.

Napa

Napa County's Plan calls for continuation of ongoing water quality sampling programs such as the existing Baseline study, with added goals to include locating boron sources in the Calistoga area. A special sampling program will seek the sources of high coliform counts in Conn Creek.

The County, cities and the Resource Conservation District will review existing practices for low or no cost opportunities to reduce pollutants. Examples include sedimentation basins at construction sites, rescheduled street sweeping for fall leaf pickup and pasture management to reduce overgrazing.

The existing practice of notifying property owners to remove illegally dumped refuse from watercourses will be reviewed for effectiveness, and additional controls will be implemented if necessary.

San Francisco

The City of San Francisco has developed a master plan for wastewater management and has a schedule for implementation. The program to be addressed was unique in the Bay Area. The city has a combined sewer system and as a result, during periods of rainfall the flow in the system exceeds the capacity of the treatment plant. The yearly excess, about 6 billion gallons, is discharged untreated an average of 82 times a year for a duration of about 200 hours from thirty-nine outfalls around the periphery of the city. The receiving waters and beaches are adversely affected about one-third of the year.

The master plan concept is one of an integrated and balanced system of treatment, storage/transport and pumping facilities. The design is complete for an expanded treatment plant on the Bay side of the city to provide for secondary treatment of dry weather flows. Construction contracts are being advertised in late 1977 and early 1978. The construction of the system to transport dry weather flow from the northeast area of the city to the new southeast plant is nearly completed. Facility planning is underway for a new secondary plant to treat all dry weather flows from the west side of the city. Included in this investigation is the planning for wet weather treatment facilities as well as an investigation of the requirements and potential for wastewater reclamation. A system of transport/storage structures will collect and store surface runoff together with domestic wastes until treament can be provided at treatment plants. Contracts have been awarded for six major wet weather transport/storage and pumping facilities for the west side of the city. A new deep water outfall is under design and facility planning for the remainder of the west side facility is under way.

In accordance with Regional Water Quality Control Board requirements, the major portion of the storage system is designed to overflow on the average of once per year. Some areas are allowed four overflows per year and limits are not yet established for others.

Non-point sources of runoff to the receiving waters are minimal in the city. They are located in a small area along the west shoreline at Fort Funston and a small area at the headlands near the Golden Gate. The other areas of the city are developed and sewered to the extent that surface flow is intercepted. When complete the 1.25 billion dollar integrated system will treat all dry weather flow and control and retreat over 95% of all surface runoff.

San Mateo

The San Mateo County Surface Runoff Management Plan was prepared under the policy guidance of local cities, districts and citizens. The study to date found surface water runoff is not a major problem for water quality in this County. Most of the waters in the County are in good condition due to wise watershed planning, massive sewage discharge cleanup, and other existing public works and planning services.

The study did find, however, that surface runoff can carry materials into our waters which are either unattractive or not particularly good for our waters or the life they support. But while the possible sources of water pollution are widespread, specific water quality problems were harder to identify and seem to occur in small or isolated locations. Importantly, the sources of runoff pollution also contribute to other problems which are already costing the County for cleanup or abatement services. These problems include aesthetics, drainage and flooding, and habitats for mosquitoes and rats.

The County's Surface Runoff Plan outlines a low-cost five-year program to help reduce some of the potential sources of these related problems, particularly in areas draining to known water quality trouble spots. It stresses public education and prevention, but it also emphasizes working toward more efficient use of present cleanup equipment and existing services and controls. These improvements will be developed from the suggestions of local jurisdictions working together to identify and solve local problems.

Santa Clara

The exact nature and magnitude of most surface runoff problems is still largely unknown. The lack of rainfall, together with other factors, have made it difficult to assess the severity of existing problems. The draft plan supports continued effort to determine more precisely the nature and magnitude of surface runoff pollution problems.

In both the undeveloped and developed areas of the county, erosion and siltation problems are the major concerns which need to be addressed. These problems are supposed to be addressed through the adoption of erosion control ordinances and through effort by local Resource Conservation District plans.

Within developed areas of the county, automobile oil and grease and heavy metals from auto exhaust and brake linings are major concerns, as are silt and debris. Efforts to prevent dumping of used oil in storm drains center on public education and on establishing and expanding used oil recycling stations. Street sweeping, storm drain cleaning, and litter control programs already underway are the main means proposed for mitigating litter and debris problems in the urban area. Street sweeping may also help mitigate problems related to heavy metals such as lead from auto exhaust.

Sonoma

The (1978-1980) initial phase of the locally developed Sonoma County Surface Runoff Management Plan provides for initiation of practices which would reduce potential and suspected surface runoff problems. The plan includes creation of a Surface Runoff Quality Committee to coordinate programs of education regarding polluting materials and actions, inter-agency coordination and cooperation improved street sweeping and dissemination of best management practice, information through flyers in areawide mailing and media releases. Adoption of erosion control, drainage, and litter ordinances are called for in the initial period. Regional assistance from ABAG with education programs and from SFBRWQCB with surface water quality monitoring is expected. State and/or Federal funding assistance is expected for regional activities or where local funds are not available.

If needed, the (1980-1983) continuing planning period specifies actions which would be more costly and would be instituted only if the required level of surface runoff water quality is not achieved by the initial planning period actions.

Solano

The draft Solano County Surface Runoff Management Plan proposes several control measures and programs. These proposals include: the creation of a 208 Surface Runoff Control Office within existing county departments to implement the plan, improve street sweeping activities through updated techniques and a possible monitoring program, a public education program to explain methods used to prevent pollution from home application of pesticides and fertilizers, investigation of an oil recycling program to provide a way for citizens to dispose of used oil, continuation of the current five-year septic tank inspection program, updating or drafting erosion control ordinances for the county and cities, and the encouragement of best use practices for agricultural activities and the adoption of a creekside ordinance to further control erosion and siltation.

These measures will be implemented over a six-year period with emphasis on the first two. The County, local affected cities, special districts and other agencies will be responsible for carrying out the plan control measures and programs in coordination with the County 208 Planning Agency and affected regional agencies.

3. Regional Overview of the Proposed Control Measures

The purpose of this section is to provide a regional overview of the individual county plans discussed in the previous section.

The discussion of county plans distinguishes between initial plan implementation and the continuing planning process. The initial phase includes all control measures scheduled for implementation during the first two years of the plan (generally the period from July 1, 1978 to June 30, 1980). The continuing planning process includes those control measures which are to be implemented during the third through sixth years of the plan. The continuing planning process also includes control

measures for "future consideration." These are additional control measures suggested if the initial phase and continuing planning process control measures prove to be inadequate for addressing the water quality problems.

(a) *Initial Plan Implementation:* Table 4 presents the control measures for immediate implementation. It amounts to a compliance schedule for their implementation. Over eighty specific control measures are listed. They are divided into five major categories:

- measures to reduce accumulation of pollutants prior to runoff
- measures to reduce amount of pollutants in runoff
- measures to treat and store runoff
- measures to control land use
- miscellaneous measures (such as establishing monitoring and public education programs and an administrative framework for effective plan implementation).

(b) *The Continuing Planning Process:* Most county plans devote considerable attention to the continuing planning process. Table 5 contains control measures considered for this phase of the plan. It has a similar organization to Table 4, but since it covers a longer time period, it is less specific.

(c) *Plan Emphasis:* The main emphasis in the county plans is placed on developing control measures to reduce the accumulation of pollutants prior to runoff, establishing monitoring and educational programs, and continuing efforts to further identify problems and reduce pollutant loads. The most common actions include:

- improve street sweeping. It includes revision of street sweeping schedules with the objective to place a concentrated effort just before and during the rainy season. Other techniques include instituting parking regulations to allow sweepers access to curb areas, training street sweeper operators to increase pick-up of fine particles (which contain a high percentage of pollutants), and further studying existing street sweeping practices for future modifications as part of the continuing planning process.
- control use of certain chemicals. Recommendations range from regulating pesticide usage to educating home users of chemicals.

Table -4 INITIAL PHASE, SURFACE RUNOFF MANAGEMENT PLAN

Table includes only those control measures which are recommended above and beyond existing practices. Some counties already employ many of the control measures stated on the table but not indicated with a bar.

Measures to reduce accumulation of pollutants prior to runoff

- Improve Street Sweeping

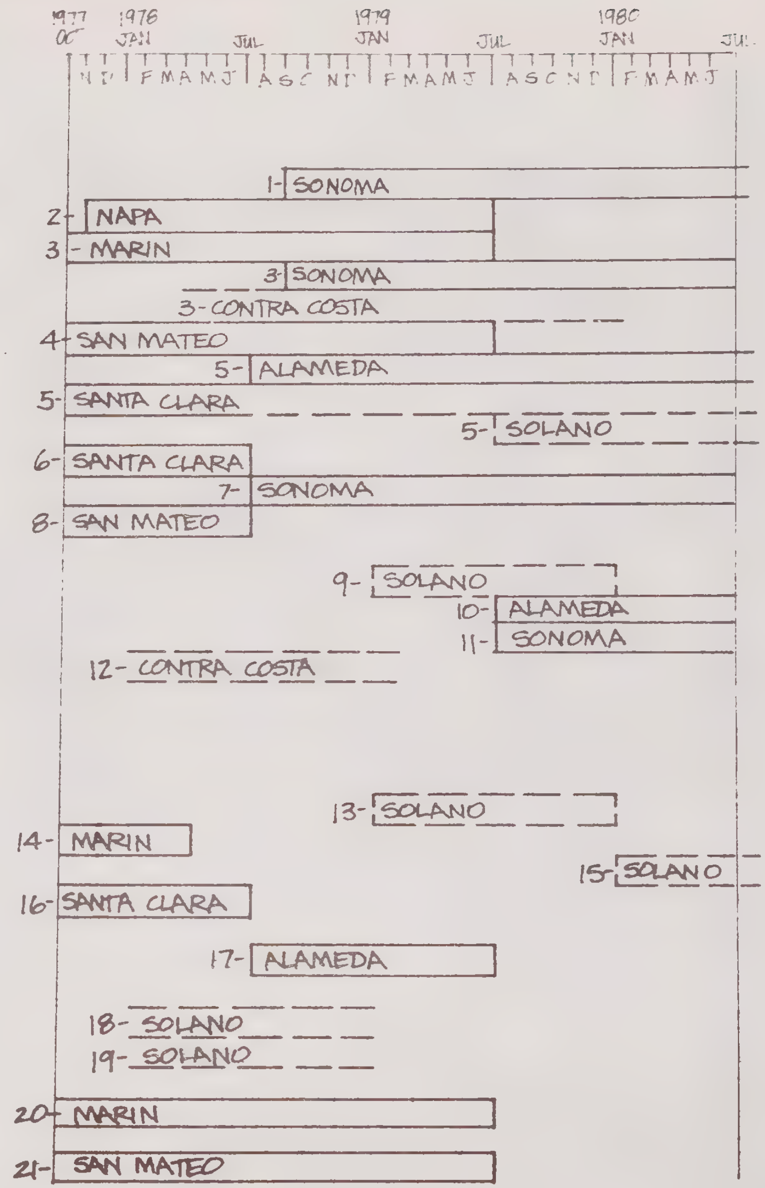
1-Concentrate street sweeping prior to rainy season
2-Revise street sweeping schedule to emphasize leaf pickups during fall and winter
3-Impose parking restrictions to allow sweeper access to curb areas
(on a voluntary basis in Contra Costa Co.)
4-Develop model approaches to reduce on street parking while sweeping
5-Conduct demonstration projects
6-Monitor effectiveness of existing programs
7-Document existing and past problems and verify sweeping plans with actual sweeping activity
8-Develop means to help local jurisdictions maintain high levels of street sweeping especially during rainy season and to increase the pick-up of fine particles while sweeping.
9-Establish guidelines for improving street sweeping effectiveness
10-Implement street sweeper operator training program and adjust schedules
11-Initiate sweeping program in high density unincorporated areas where curbs and gutters exist
12-Encourage county and cities to review sweeping schedules in densely populated and commercial areas to determine if a more efficient schedule can be devised

- Control Use of Certain Chemicals

13-Initiate public education program aimed at home users of chemicals
14-Attach information sheet to agricultural spray permits
15-Identify critical habitats and potential impacts of chemicals
16-Regulate use of certain pesticides
17-Evaluate agricultural chemical use practices

- Clean Stormwater Collection System

18-Clean catch basins
19-Implement catchbasin elimination program and minimize installation of new catch basins
20-Review present cleaning programs and implement indicated improvements
21-Develop model approaches to cleaning storm drains



Note: Dashed lines indicate that precise timing of control measure is not shown in county plan. Bar with open end indicates that timing extends beyond the limit shown on the table.

Table-4 INITIAL PHASE (continued)

● Control Littering

1-Develop anti-litter program
2-Develop public education program
3-Draft and adopt litter control ordinances and monitor
4-Develop model approaches to reduce littering

● Control Dumping

5-Draft and adopt watercourse protection ordinance
6-Establish used oil recycling program
7-Develop model approaches to recycle oil
8-Notify property owners along streams to remove refuse or face court action
9-Develop model approaches to dumping controls
10-Educate public on consequences of dumping
11-Increase enforcement to highest practical level
12-Consider adequate trash pickings, recycling centers or other options in areas where illegal dumping is perceived as a problem

● Repair Streets

13-Include water quality benefits as a consideration in street repair guidelines

● Insure Proper Operation of Septic Tanks

14-Review and modify septic tank criteria

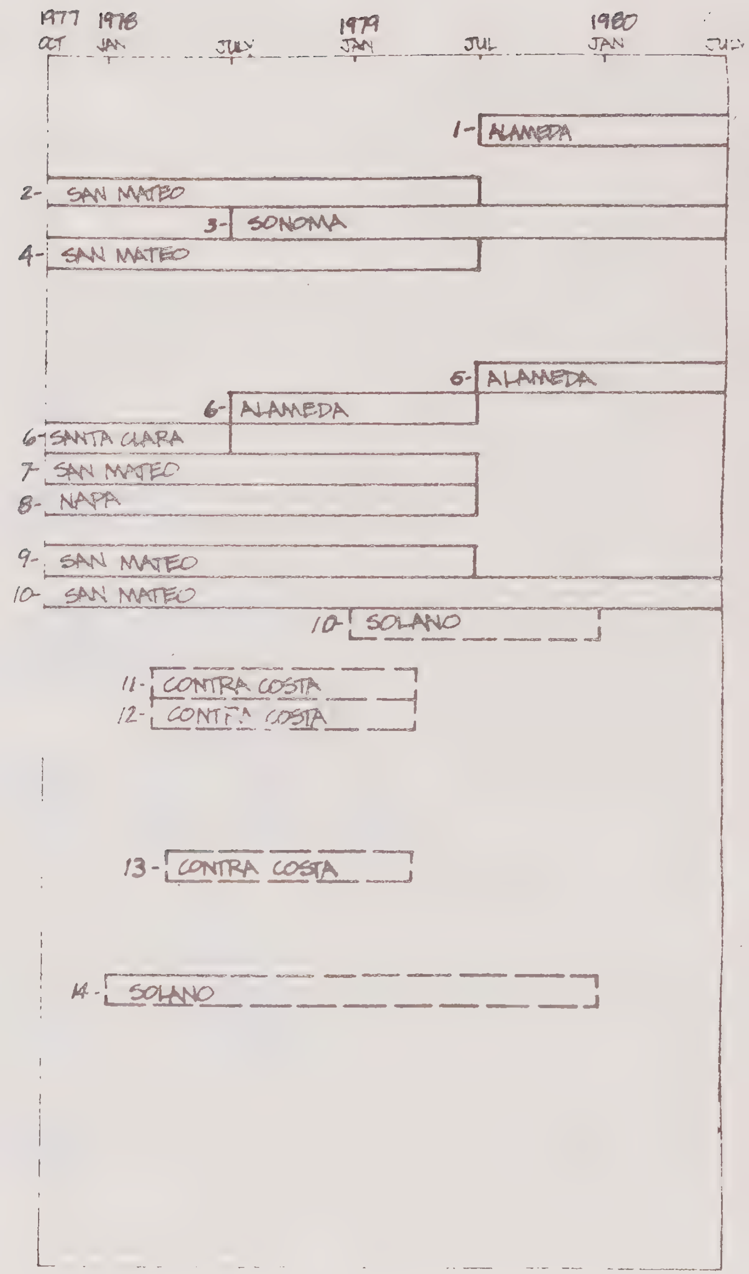


Table-4 INITIAL PHASE (continued)

Measures to reduce the amount of pollutants in runoff

- Control Erosion

1- Establish erosion control ordinances
2- Increase enforcement of erosion control requirements in grading ordinances and in ordinances pertaining to drainage and landscaping
3- Revise grading and filling ordinances
4- Include construction site controls in project review with conditions of approval needed
5- Analyze effectiveness of existing erosion control requirements and recommend improvements
6- Insure that agencies involved in construction and maintanance activities utilize BMP's for erosion control.
7- Encourage landowners, SCS and RCD to work cooperatively together to prevent excessive soil losses
8- Improve roadside drainage
9- Develop and implement flexible road standards for sensitive areas
10- Stabilize stream channels/encourage streambank stabilization
11- Defer seeding of cut and fill slopes to just prior to rainy season
12- Emphasize check dams and/or sediment basins at construction sites
13- Identify critical areas and applicable controls
14- Require erosion control considerations in EIR's/EIS's

- Improve Agricultural Practices

15- Improve range management practices/encourage range management to reduce overgrazing
16- Examine agricultural practices
17- Prepare land management plans (by RCD's)

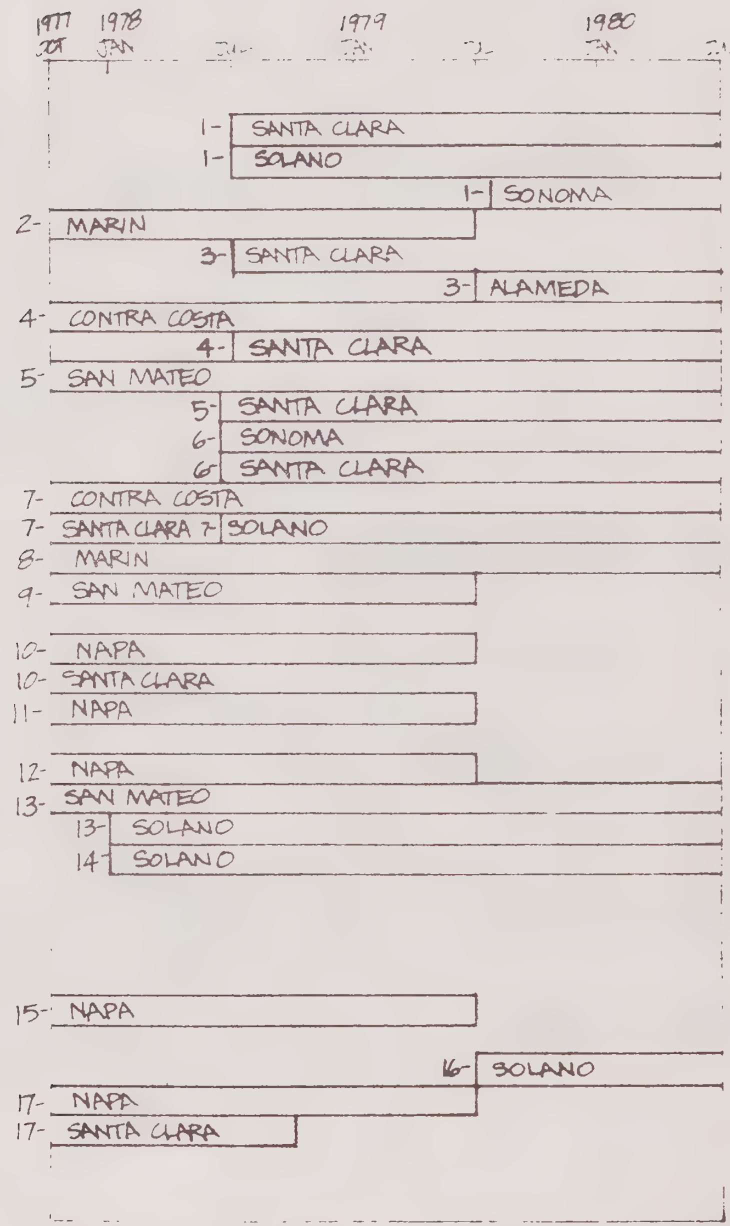


Table 4 INITIAL PHASE (continued)

● <u>Divert Runoff From Contaminated Areas</u>
1-Prohibit flushing of materials from impervious surfaces
2-Draft and adopt drainage ordinances (Monitor effectiveness yearly)

Measures to treat and store runoff

3-Determine most effective treatment technique for septic tank problem area and apply for 201 grant
4-Further investigations of sewerline infiltration problems
5-Set up pilot project to determine role of flood control basin in mitigating runoff pollution and seek funding

Measures to control land use

6-Develop creekside buffer strip requirements or setbacks
7-Establish performance standards for development within water supply watersheds
8-Regulate sensitive lands
9-Prohibit fishing in reservoirs and streams where high mercury concentrations are found

other measures (monitoring, education and continuing planning)

● <u>Establish Water Quality Monitoring Program</u>
10-Establish a continuous monitoring program
11-Survey or sample to find causes of specific problems
12-Coordinate with state and federal agencies in monitoring offshore waters
13-Determine magnitude of specific problems

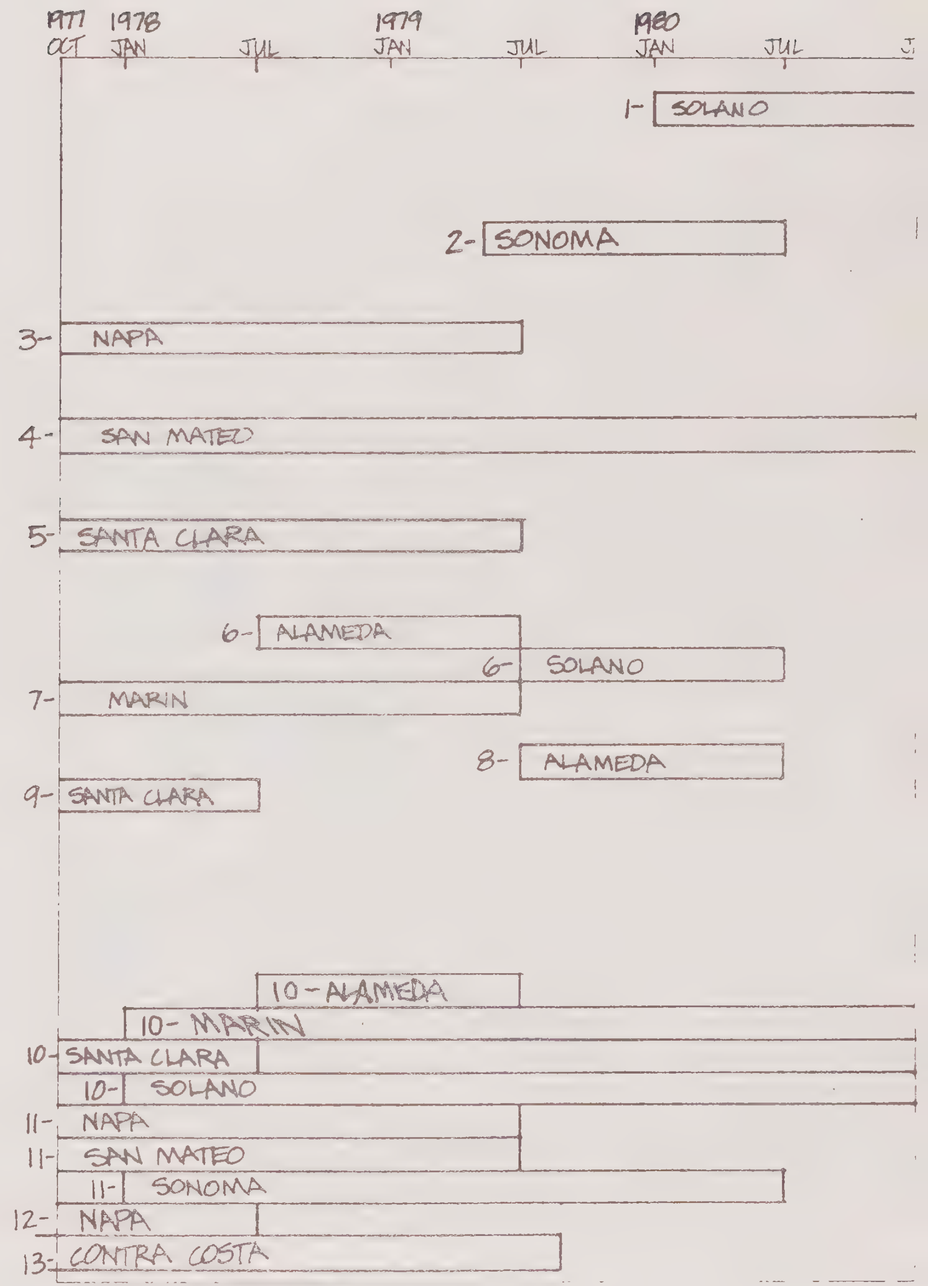


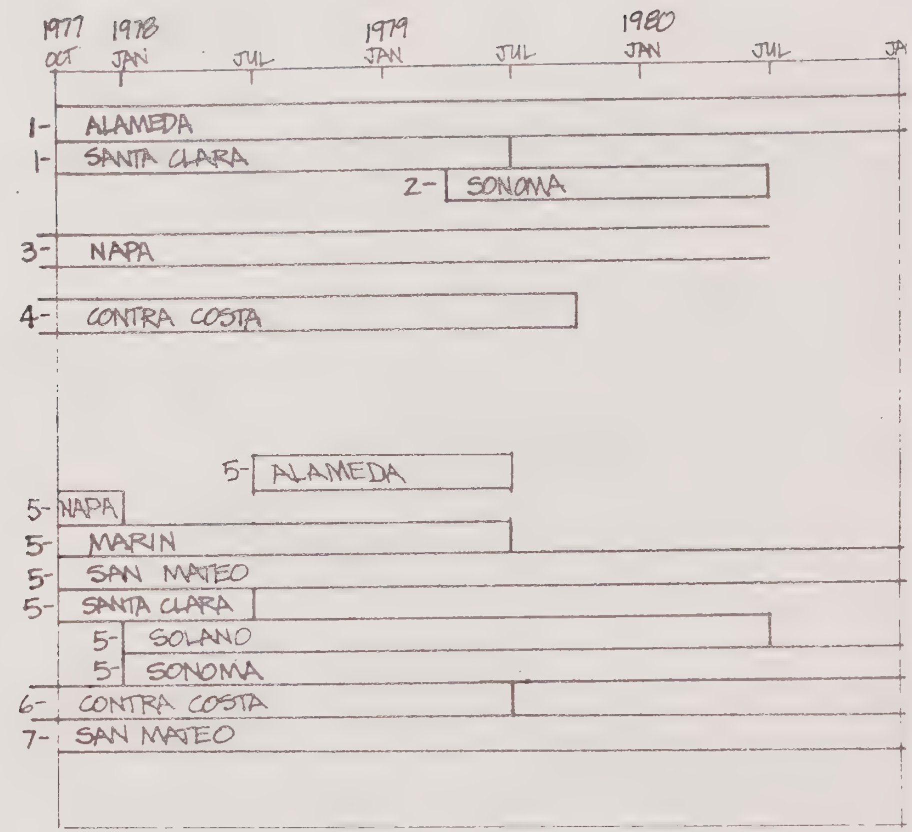
Table -4 INITIAL PHASE
(continued)

1- Conduct sampling program to measure the effectiveness of existing control practices

2- Monitor pollutant buildup from use of reclaimed wastewater

3- Periodically review water quality monitoring reports of other agencies

4- Precisely identify monitoring locations and contract to monitor



• Establish a Public Education/Information Program

5- Establish public education/information programs regarding water quality consequences of dumping, littering, use of chemicals, construction and grading, best management practices...

6- Aid in preparing concepts and materials for the regional public education system

7- Establish a pilot education program for a test area

Table-4 INITIAL PHASE (continued)

- **Establish a Surface Runoff Administrative Structure and Procedures for Continuing Planning**

1- Establish a Surface Runoff coordinating body
2- Establish or continue a 208 advisory committee (public participation committee)
3- Establish procedures for annual review and update of plan
4- Prepare annual reports, including recommendations for following year
5- Document local agency actions to implement plan
6- Document past and existing problems and review ordinances
7- Establish a program to solve documented problems
8- Establish resource recycling subcommittee
9- Encourage cooperation and coordination of activities among agencies involved with water quality
10- Aid cities, special districts and county to prepare wording to be incorporated into EIR requirements to require further water quality considerations
11- Establish local cost sharing mechanisms for annual plan update
12- Determine cost and financing mechanisms for each annual work program
13- Investigate non-local funding sources

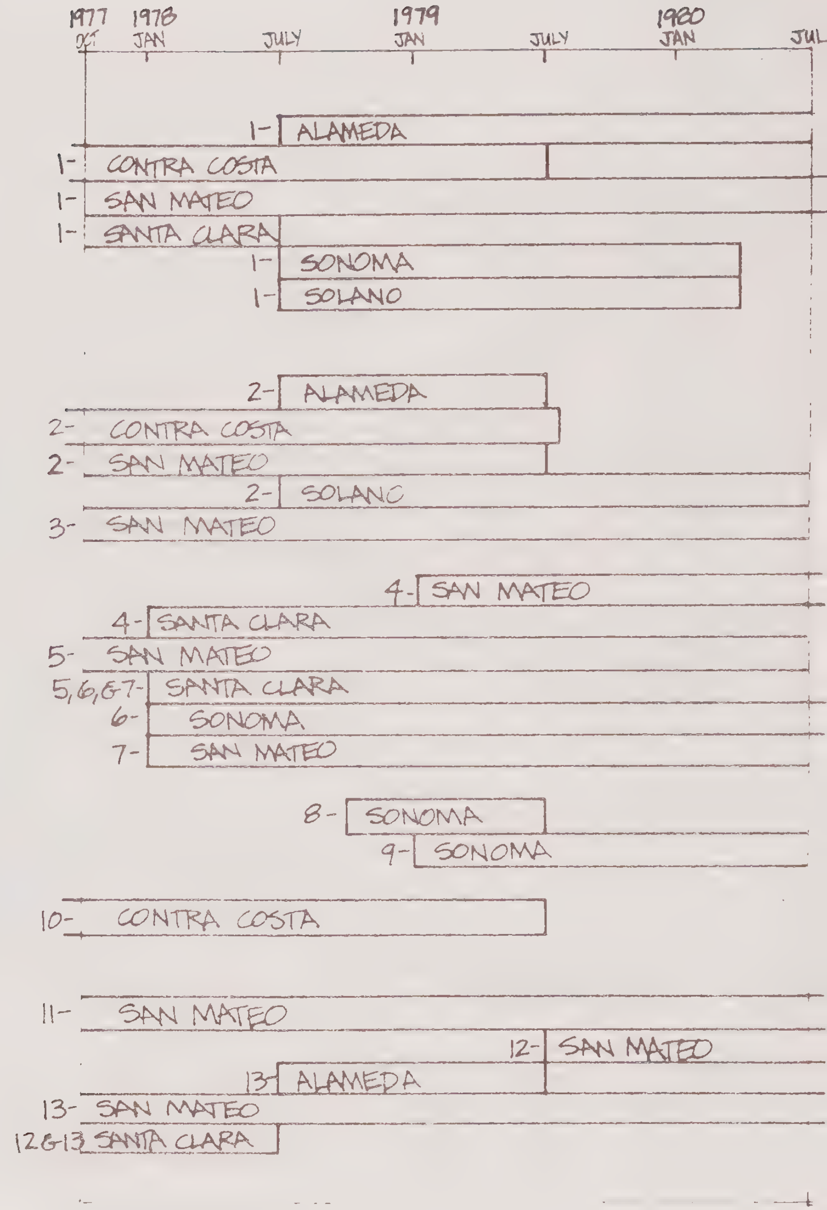


Table -5 CONTINUING PLANNING PROCESS

Measures to reduce accumulation of pollutants prior to runoff

- Improve Street Sweeping
1- Investigate increasing street cleaning
2- Increase street sweeping frequency (if needed)
3- Investigate expansion of parking controls
4- Implement recommended improvements in street sweeping program
5- Encourage inter-jurisdictional sharing of equipment and manpower
6- Increase number of curb miles swept, including new areas and more intensity in existing areas
7- Use vacumn sweeper
8- Purchase new sweeping equipment
9- Begin street flushing

- Clean Stormwater Collection System
10- Clean storm drains and open channels
11- Investigate additional storm drainage channel cleaning
12- Investigate additional cleaning of catchbasins
13- Develop model approaches for cleaning catch basins, storm drains, etc.
14- Implement recommendations on model approaches to cleaning storm drains

- Control Littering
15- Enforce litter laws
16- Prohibit sale of non-returnable containers
17- Implement public education program

- Control Dumping
18- Enforce prohibition on dumping
19- Collect residential landscape debris
20- Determine magnitude of problem and implement additional controls if necessary

- Repair Streets
21- Begin repairing streets to facilitate street sweeping

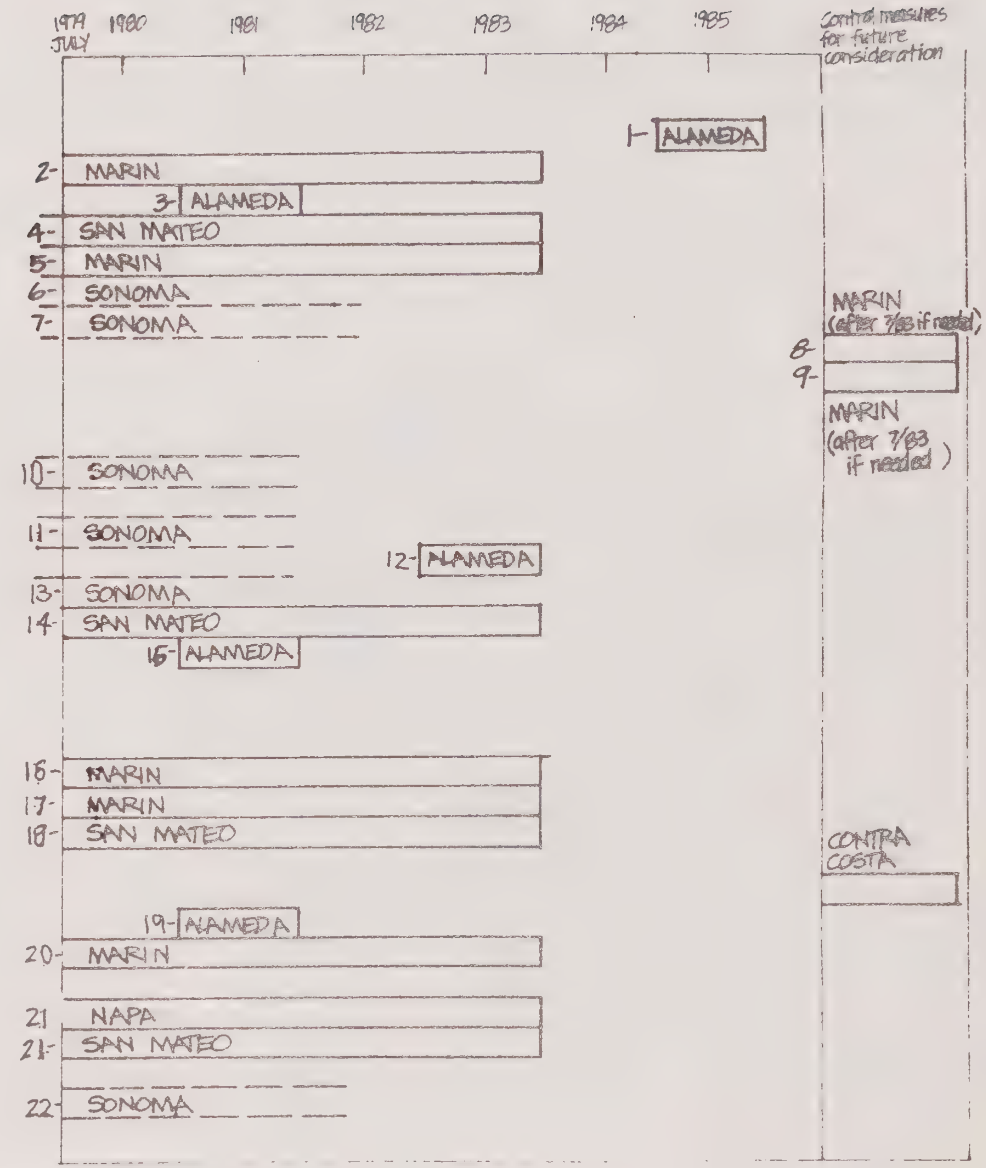


Table-5 CONTINUING PLANNING PROCESS (continued)

- Insure Proper Operation of Septic Tanks

1- Consider new septic system design and construction techniques
2- Monitor the septic tank inspection program

- Control Erosion

3- Establish erosion control ordinances
4- Establish a program to improve erosion and runoff controls in areas with utilize existing or potential problems
5- Encourage land owners, SCS, + RCD to work cooperatively to prevent excessive soil loss
6- Develop and implement flexible road standards for sensitive areas
7- Stabilize stream channels/Encourage streambank stabilization
8- Regrade and revegetate disturbed areas
9- Increase enforcement of existing erosion control requirements

- Improve Agricultural Practices

10- Develop agricultural erosion control program
11- Improve range management practices/Encourage range management to reduce overgrazing
12- Restrict Horse grazing

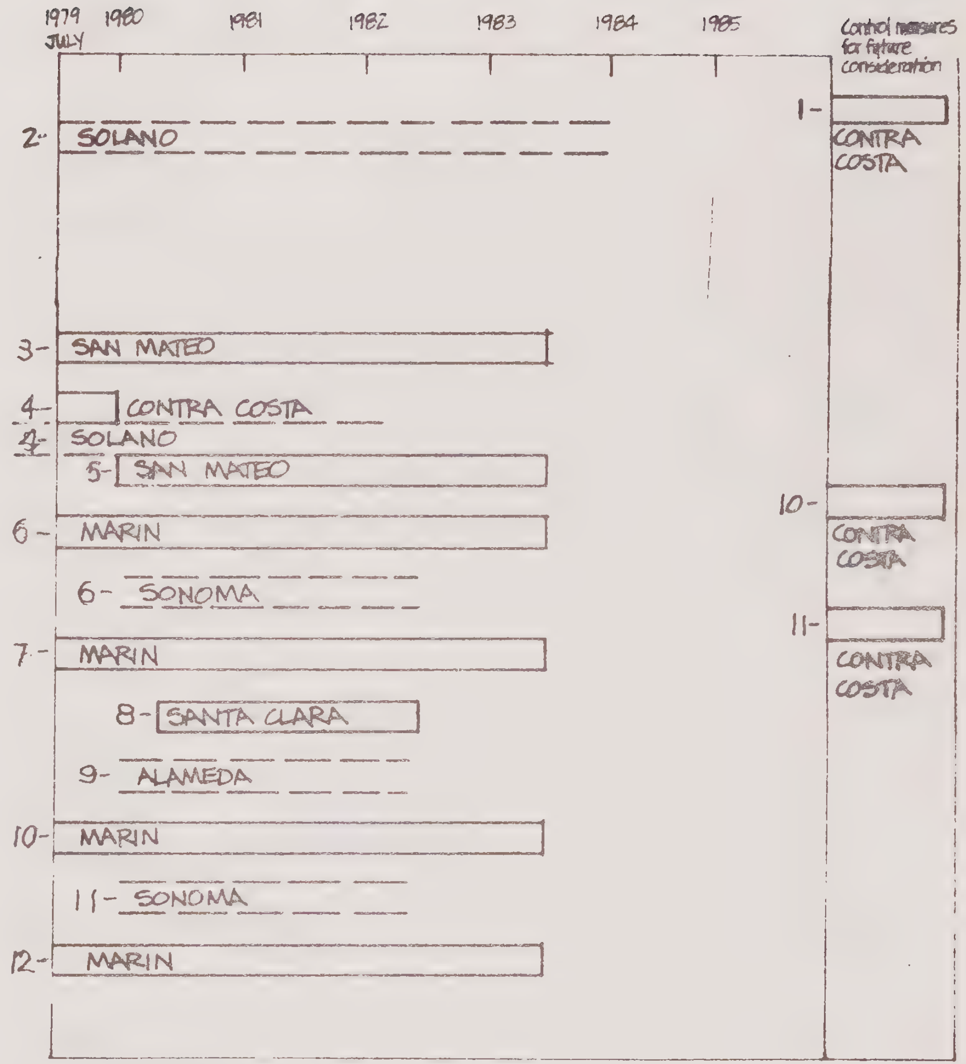


Table -5 CONTINUING PLANNING PROCESS (continued)

- <u>Divert Runoff from Contaminated Areas</u>

1- Divert runoff from contaminated areas
2- Prohibit flushing of materials from impervious surfaces

- <u>Other measures</u>

3- Diversion ditches, conservation irrigation, sediment control basins, waste management systems
4- Eliminate connections of roof drains to storm drains
5- Draft and adopt drainage ordinances (and monitor effectiveness on annual basis)

6- Set up pilot project to determine role of flood control basins in mitigating runoff pollution
7- Control direct discharge of pollutants
8- Control use of lots and streets

Measures to treat and store runoff

9- Construct treatment facility to replace faulty septic tank systems
10- Construct treatment facilities for surface runoff
11- Retain runoff on roof tops and highly contaminated areas
12- Impound runoff in upstream channels
13- Construct off-line storage (ponding)
14- Use excess capacity of treatment plants
15- Eliminate crossconnections of storm drains and sanitary sewers

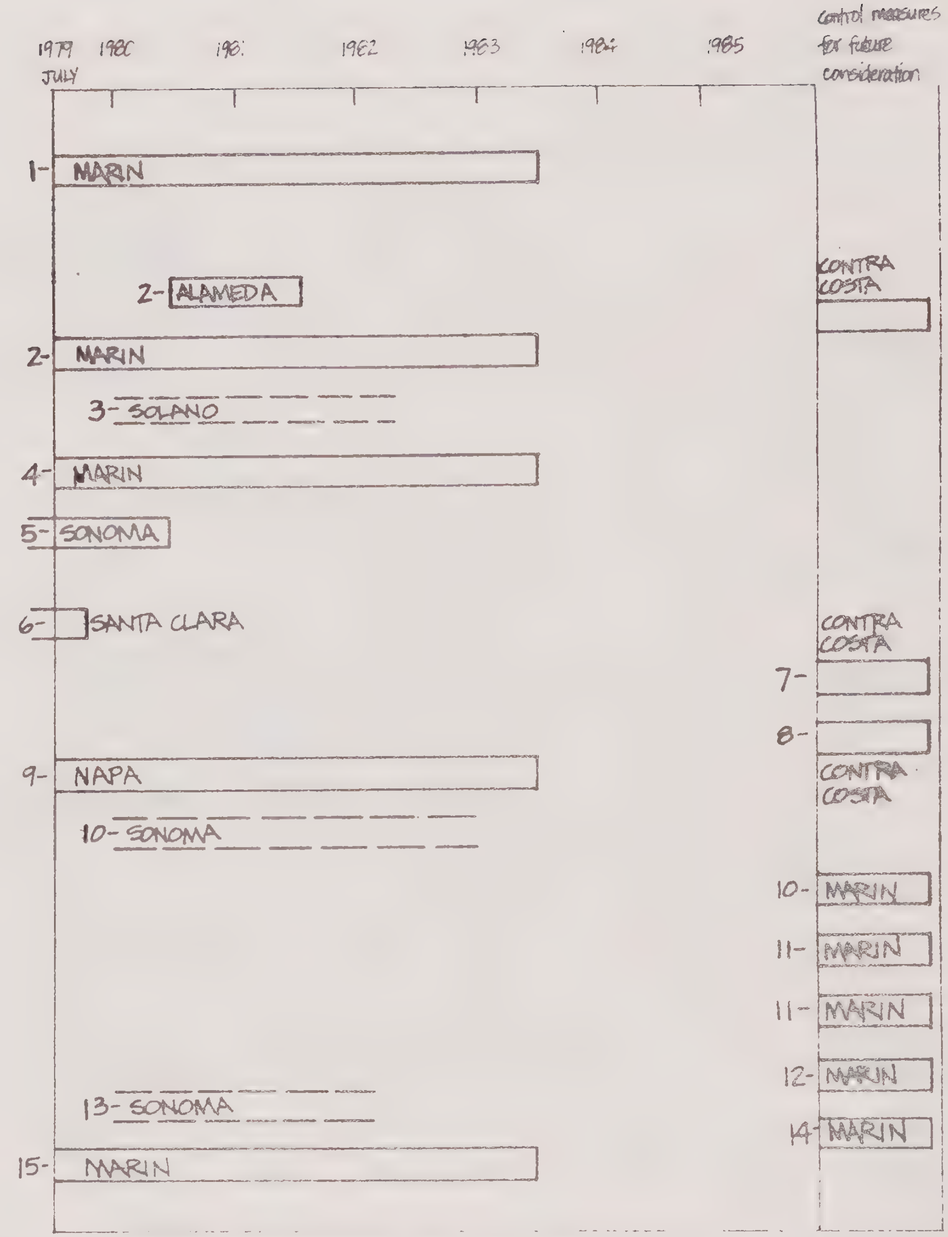


Table-5 CONTINUING PLANNING PROCESS
(continued)

1-Further investigate sewer line infiltration problems
2-Investigate exfiltration problems
3-Investigate use of stormwater detention facilities and treatment of runoff

MEASURES TO CONTROL LANDUSE

4-Develop creekside buffer strip requirements or setbacks
5-Establish performance standards for development within all rural watersheds
6-Control development patterns
7-Regulate sensitive lands
8-Coordinate landuse with Napa County
9-Develop supplemental control program for coliform problem in watershed

Other measures (monitoring, continuing planning)

- Establish Water Quality Monitoring Program

10-Coordinate with state and federal agencies in monitoring the offshore waters

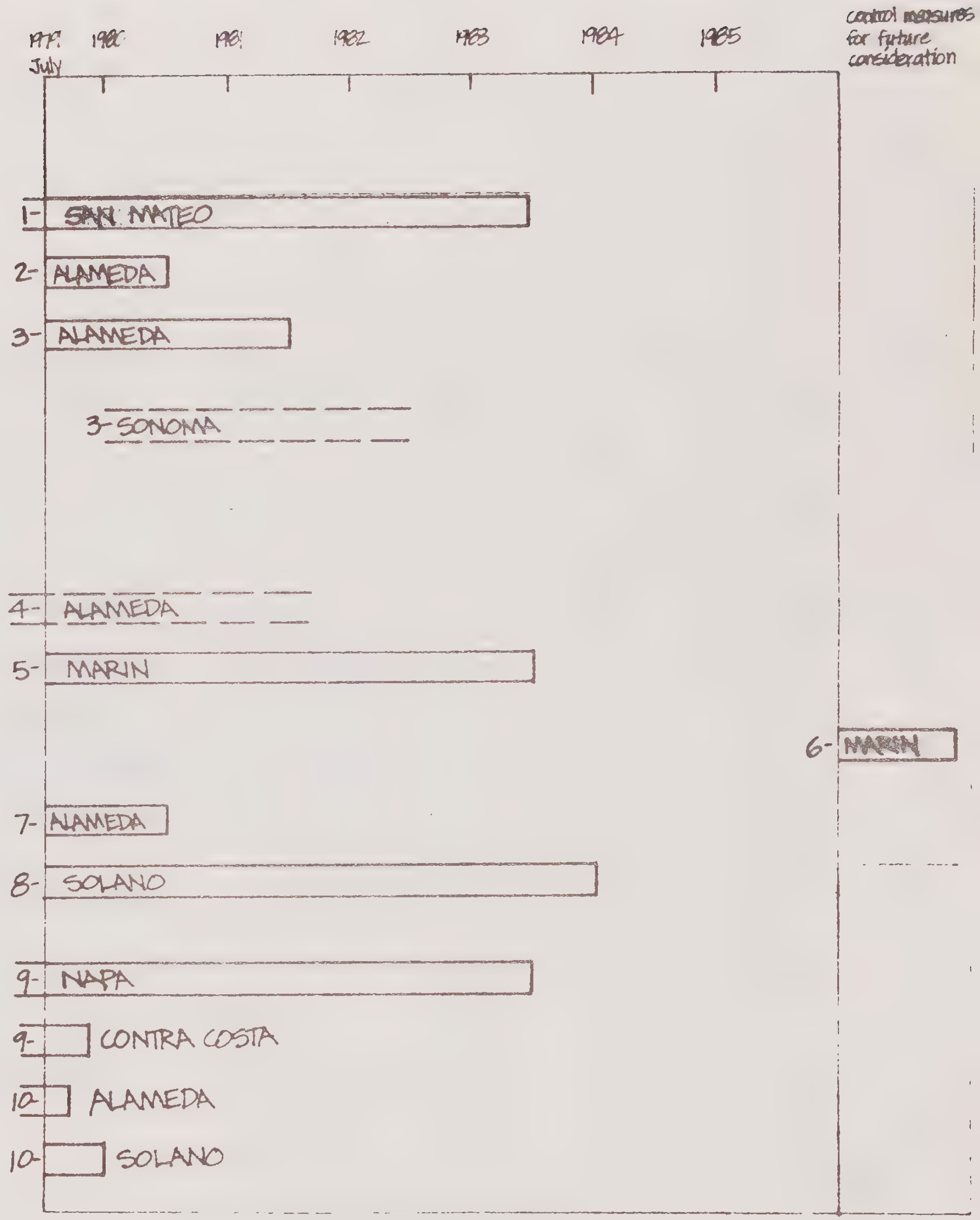
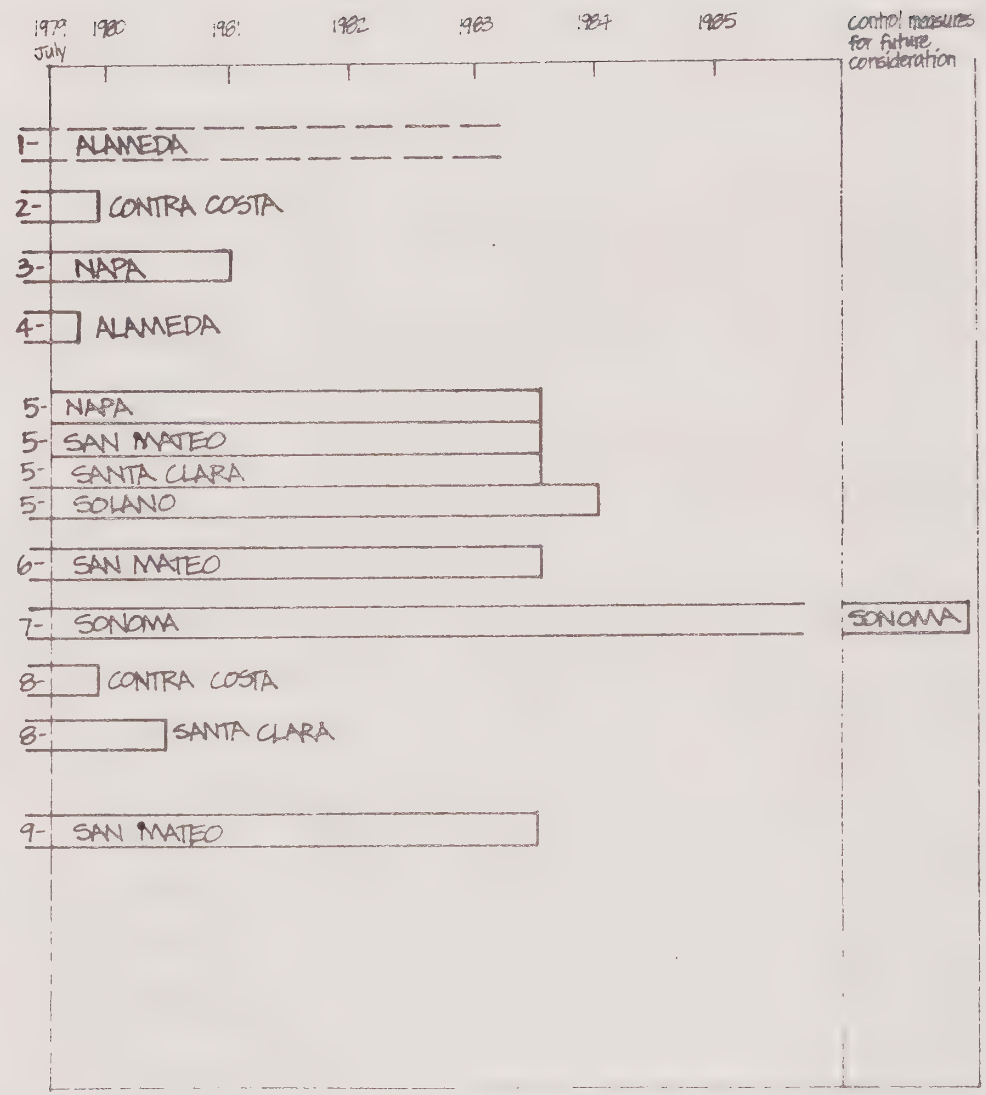


Table-5 CONTINUING PLANNING PROCESS

1- Conduct sampling program to measure the effectiveness of existing control practices
2- Precisely identify monitoring locations and contract to monitor
3- Periodically review water quality monitoring reports (of other agencies) (and analyze - Phase II)
4- Investigate public works maintenance operation and construction practices

• Establish a 208 Administrative Structure and Procedures for Continuing Planning
5- Prepare annual reports
6- Document local agency control measure practices and evaluate their effectiveness
7- Document past and existing problems and review ordinances
8- Aid cities, special districts and county to prepare wording to be incorporated into EIR/EIS requirements
9- Determine cost and financing mechanisms for each annual work program



- clean stormwater collection system. This control measure includes recommendations ranging from improving cleaning of catch basins and storm drains to cleaning open channels.

- control dumping. Recommendations include oil recycling programs, enforcement of existing ordinances, drafting a watercourse protection ordinance and neighborhood composting

- develop anti-littering program. Recommendations include public information programs, placement of litter receptacles and strict enforcement of ordinances.

- control erosion. Recommendations include increasing enforcement of existing ordinances, drafting additional requirements where needed, stabilizing stream banks and requiring erosion control considerations in EIRs and project review guidelines.

- establish water quality monitoring program. All counties saw the need to further sample water quality to better define existing problems and measure the effectiveness of control measures.

- establish public education/information program. It was concluded that the public generally lacks awareness of the relationship between polluting substances and their impact on water quality. All counties therefore suggested various forms of educational programs.

- establish procedures for continuing planning. Recommendations included establishing surface runoff coordinating bodies in the counties, documenting control measure practices and their effectiveness and making recommendations for annual revisions, and determining financing mechanisms for annual work programs.

(d) *Demonstration Projects:* All counties see a need to initially demonstrate the cost-effectiveness of proposed control measures. The plans put a great deal of emphasis on such pilot projects.

(e) *ABAG's Role:* Most counties identified several tasks which would be best accomplished at the regional level. These are discussed in the following section.

4. Plan Recommendations For Regional Implementation

In developing the Surface Runoff Management Plan, each county was responsible for developing control measures for dealing with surface runoff problems in that individual county. In this process all counties identified certain actions and services that could best be accomplished on a regional level. There are several reasons why the counties made this recommendation:

- To minimize duplication of effort. For example, there is no need to have eight counties individually research and prepare model erosion control ordinances or develop certain educational materials.

- To facilitate information transfer. The surface runoff program demonstrated that it was highly beneficial for the counties to have a regional clearinghouse for the collection and distribution of technical information.

- To achieve a coordinated approach. Each county desired to know what the other counties were doing. There was also a concern to achieve a certain consistency of effort among the counties.

To meet the above concerns a regional work program was developed (see Table 6). It is consistent with the scheduling of the individual county plans. The specific functions identified for ABAG are as follows:

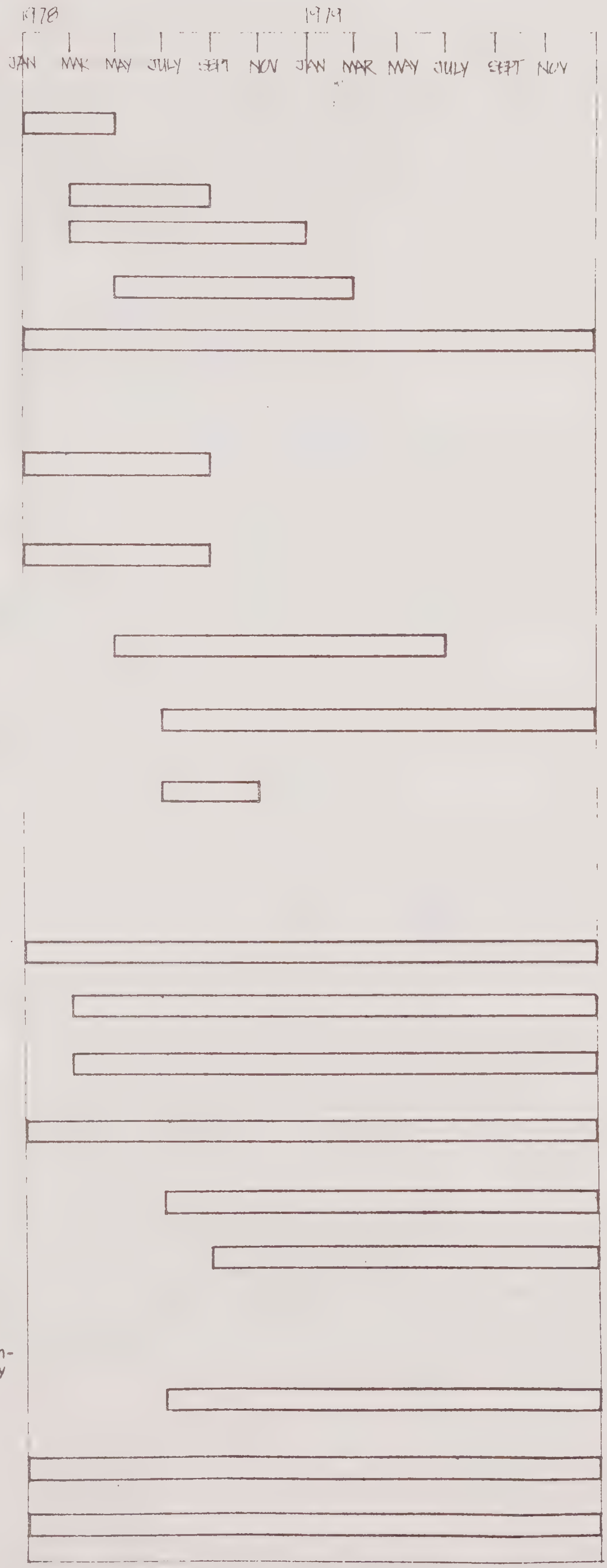
- *Continued Management of the Surface Runoff Program:* The plan recommends that the present structure of the Surface Runoff Management Program be maintained. In the face of this program's complexity, the continuation of the existing structure will facilitate communication between Federal, State and local agencies as they implement the plans.

- *Coordination of Data Gathering:* The plan recommends that ABAG serve the function of gathering baseline data for problem identification. In the plan development process it was recognized that water quality and quantity data are collected by many organizations. Currently, much data collection proceeds without the clear understanding of what information is required for management-level decisions. A regional agency could assist in coordinating data gathering and storage, analysis and dissemination. This will reduce duplication of effort, provide central data storage, and make the data readily available.

- *Technical Information Exchange:* Water quality data is not the only type of information which is required for water quality management. Other information includes cost and effectivenes of control measures. The plan recommends that ABAG collect and disseminate this technical information for the counties in the continuing planning process.

- *Preparation of Model Ordinances:* The plan recommends that ABAG assist the counties in developing model ordinances for control of surface runoff related problems. Specific model ordinances which have been requested by the counties are: erosion control, range management, performance standards for sensitive lands, streambank protection, litter ordinances and recycling controls.

Table-6 WORK PROGRAM FOR REGIONAL IMPLEMENTATION



DEVELOP MODEL ORDINANCES AND FACILITATE INFORMATION TRANSFER

1. Assemble information on existing ordinances (erosion and grading, littering, dumping, buffer strip or setback, performance standards for sensitive lands, etc.)

2. Assess merits of the various ordinances. Determine which ordinances or portions thereof are most successful.

3. Prepare model ordinances

4. Disseminate information on model ordinances to counties. Provide case study examples.

5. Provide guidance and consultation to local governments which are drafting ordinances.

DEVELOP EDUCATIONAL PROGRAMS

1. Prepare media (TV, radio, newspaper) materials to inform public of impacts of dumping and littering on water quality

2. Prepare guide to recycling programs in Bay Area (including description of recyclable materials, map showing location of stations, hours of operation, benefits to be achieved by recycling)

3. Prepare workbook or brochure for schools, libraries which emphasize the benefits of good land management practices and illustrate these practices.

4. Prepare displays for schools, libraries and other public buildings which illustrate the above.

5. Prepare informational brochure about the proper use and disposal of harmful chemicals.

COORDINATE TECHNICAL INFORMATION EXCHANGE

1. Collect technical information (reports, handbooks, papers and other documents) from federal and state agencies, universities, etc., which deal with pertinent water quality issues.

2. Circulate lists and abstracts of the above documents to appropriate local government agencies and staff.

3. Disseminate documents as requested.

4. Collect information from monitoring programs and control measure demonstration projects taking place in the region.

5. Compile and analyze this information and prepare periodic reports.

6. Distribute above information on a regular basis to other local governmental agencies.

PROVIDE DIRECT TECHNICAL ASSISTANCE TO COUNTIES

1. Organize technical workshops to provide training and dissemination of information directly to county and city technical staff (surface runoff monitoring, modeling, control measures, legislation).

2. Meet with county and city personnel individually as requested.

3. Conduct meeting with all counties present to exchange information and coordinate efforts.

- *Educational Programs:* The counties recognize that a public education program regarding surface runoff pollution and its sources would be desirable. To avoid duplication of effort, it was felt that a regional approach would be appropriate. Specific educational proposals include multi-media presentations and elementary and secondary education curricula.

- *Provide Regional Environmental Perspective on State Legislation:* The plan calls for ABAG to continue to act on behalf of citizens of the Bay Area with respect to environmental questions affecting the region, especially as it relates to the surface runoff problem.

5. Plan Recommendations for State, Federal and Private Sector Implementation

The counties specified several recommendations in their plans which they felt should best be implemented by State or Federal agencies or by private interests. These recommendations largely pertain to controls or programs which go beyond the powers of local government. Below is a summary of these suggestions:

RECOMMENDATION	SUGGESTED IMPLEMENTING AGENCY
Develop means to reduce oil leakage, toxic exhaust emissions and other undesirable byproducts of motor vehicles	Federal government, private industry
Continue Federal and State aid for infiltration/inflow analysis and sewer line repair or replacement	Federal and State government
Establish water quality monitoring program for San Francisco Bay	Regional Water Quality Control Board
Conduct oil recyling program and related public education program	Private industry, American Association of University Women
Establish a more effective procedure for involving local governments in the decisions regarding stormwater discharge permits and other enforcement or implementation policies	Federal government (EPA)

F. THE COSTS, BENEFITS AND EFFECTS OF THE PLAN

The Surface Runoff Management Plan and the County Surface Runoff Control Plans recommend the application of Best Management Practices to meet the stated goals of the Environmental Management Plan. The recommendations are not site specific, and therefore, the overall impacts of the plan differ from project level impacts. In general, the impacts of the plan, in addition to water quality effects, include:

<u>Benefits</u>

- enhanced recreation potential
- improved amenities or aesthetics
- efficiency gains for public works operations
- improved intergovernmental coordination
- health and safety benefits

<u>Costs</u>

- $1.4 million total costs of initial plan recommendations (over next 2-3 years)
- $252,000 total estimated costs per year annualized over the planning period of individual county plans (4-7) years

1. <u>Assessment Methodology</u>

The development of this plan incorporated a new assessment approach. Rather than deciding on a course of action and then justifying the decision, the assessment was an integral part of plan development. The process of plan development was as important a component of assessment as the assessment of the recommended actions themselves. The process proceeded in two phases using essentially the same methodology.

With citizen input through the public participation process and the advice of the Assessment Advisory Committee, the Environmental Management Task Force adopted an Assessment Checklist in the early phase of the Surface Runoff Management Program. The Checklist displays more than one hundred criteria considered important in assessment and evaluation of pollution control measures. The factors are organized by four major categories:

- Environmental
- Institutional/Financial
- Economic
- Social

Using the Assessment Checklist, with the advice of the Assessment Advisory Committee, ABAG staff developed a Surface Runoff Assessment Procedures Manual. The Manual outlined a methodology and provided tools to be used in assessing impacts during plan development.

The individual counties used this manual in the assessment of their Surface Runoff Control Plans. This was done in the following two phases as part of their plan development:

- o Refinement of the list of candidate control measures based on problem analysis and using the Assessment Checklist

- o Analysis of the recommended management practices with respect to the Assessment Checklist

Information about the environmental, institutional, financial, economic and social impacts of the recommended best management practices along with a complete description of the participants in plan development is contained in the individual County Surface Runoff Control Plans.

2. Assessment Overview

The assessment of the actions recommended in the Surface Runoff Management Plan appears in Table 7, Plan Recommendations Summary Table. The table provides information about the recommended actions (e.g., implementing agencies, authorities, financing mechanisms) and summarizes the overall impacts of the actions included in the county plans. For example, the summary impacts shown for Improve Street Sweeping indicate the aggregate effects of all of the street sweeping practices that the eight counties proposed in their plans. The impacts noted are statements about the impacts that could be expected from improving street sweeping.

It is not possible to quantify many of the impacts or state with certainty the likelihood that an indicated impact will occur. The exact impact depends on the specific action taken, where and how it is implemented, the actual cost and the method of financing.

Plan development in each county proceeded with extensive public participation. Advisory committees composed of public officials, county, city and special district staff members, and the public played an important role in the first level assessment process. All counties began plan development using a list of 40 candidate control measures prepared by ABAG. Having identified the surface runoff problems or potential problems in each county, lead agency staff with the aid of their advisory committees then assessed or screened the 40 control measures. The criteria varied somewhat from county to county but generally included criteria on the Assessment Checklist viewed as most important by county lead agency staff and advisory committee members, such as:

- Suitability or applicability of a control measure
- Effectiveness or water quality benefits
- Low cost
- Multiple benefits
- Public and political acceptability

Considerable program efforts and expenditures were already underway in the local jurisdictions to meet other objectives such as aesthetics and flood control. Most counties felt it important to incorporate water quality and efficiency considerations into those programs and assess the subsequent effect prior to recommending new or additional and more costly controls. The result of the first level assessment was a reduced number of control measures which represented Best Management Practices and thus a reasonable first effort at surface runoff management.

The second level assessment proceeded by assessing each Best Management Practice remaining for inclusion in draft county plans. State Environmental Impact Report requirements, Federal Environmental Assessment requirements and local project, program and permit review requirements currently serve to generate impact information for site specific proposals. The Continuing Planning Process will likewise incorporate assessment of the impacts of Best Management Practices into ongoing analysis and future program recommendations.

What then are the costs, benefits and effects of the Surface Runoff Management Plan? The cumulative impacts of the plan can be summarized by the four major categories of the Assessment Checklist.

3. Costs

During preparation of this brief not all costs of the recommendations in the County Surface Runoff Control Plans were available.

County costs were estimated by county and ABAG staff according to directions in Assessment/Evaluation Technical Memorandum No. 2. Those costs appear in Table 7, Plan Recommendations. The total costs per year of each action are expressed as annualized costs. All costs are discounted at 6-3/8% (as required in EPA's "Guidelines for State and Areawide Water Quality Program Development") and are expressed in 1977 dollars. Costs are then annualized over the indicated planning period (4-7 years).

The total estimated cost for the initial period of the Surface Runoff Management Plan is $1.4 million. The estimated annualized cost per year is $252,000. It is estimated that implementing agencies have committed $750,000 to carry out the initial phases of the Plan.

4. Environmental Impacts

The cumulative environmental effects of the Surface Runoff Management Plan, in addition to the water quality benefits discussed elsewhere, are shown in Table 7 and summarized below.

Table 7.

SURFACE RUNOFF PLAN RECOMMENDATIONS

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Policy 8 ESTABLISH A PROGRAM OF SURFACE RUNOFF CONTROLS THAT EMPHASIZE LOW COST MEASURES TO REDUCE THE POLLUTANT LOAD FROM THIS SOURCE.								
Action 8.1 Improve Street Sweeping (This action could be implemented as part of Action 1.1 of the Solid Waste Management Plan)	To develop and implement methods to improve street sweeping efficiency and maximize potential water quality benefits such as concentrating sweeping during rainy season, enforce parking restrictions on sweeping days, improve capabilities of personnel.	General purpose local governments (usually via the Public Works Department) and County Solid Waste Management Agencies	Continuous	Local ordinances; SB5	Undetermined, at least $21,200	$21,200	Local funds, supplemented at times by Federal revenue sharing; SB650 1977	SSWMB will enforce if this Action is included in the county Solid Waste Management Plans.

This column presents annualized costs. The annualized cost is the amount of money per year that would amortize the total cost of the program over the initial period (4-7 years at a 6⅞% interest rate.

*

General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Air Quality o Temporary and localized air pollutant emission increases may occur during sweeping operations o Reduced quantities of dust available for suspension as particulate matter Water Quality o Reduced transport of heavy metals, nutrients, pesticides, organic and microbiological pollutants into water bodies. Typical removals: 30-50% total solids, 25-40% BOD, 25-40% Kjedahl nitrogen , 8-20% phosphate, 25-60% heavy metals o Reduced incidence of impaired uses (e.g., water supply) of water bodies Physical Resources o May indirectly benefit aquatic organisms o Enhanced water recreation potential and use o May reduce landfill capacities needed to accommodate residues. Energy o Sweeping equipment uses energy Amenities o Improved visual amenities on paved surfaces and in water bodies e.g., reduced floatable solids o Temporary, localized noise level increases from equipment operation (70-80 dBA at 50' on flat grade). May be mitigated by noise abatement measures	Financial Direct Public Costs of Implementation o See County Surface Runoff control Plans Cost Data o Example Costs of Street Sweeping Programs $16 per cu. yd. of material collected $18 per ton of material collected $4-5 per curb mile Fiscal Effects on Local Governments o Direct impacts on fiscal resources depend on revenue source(s) used - See County Plans Institutional o May require intergovernmental coordination o May require additional staff resources to improve efficiency of sweeping programs o May impact other public service levels	Production of Goods & Services o Employment - Creation of job opportunities in the private sector may result (administrative and operation and maintenance jobs) Income and Investment o No impacts Consumer Expenditures o No impacts	Housing Supply o No impacts Physical Mobility o Temporary, localized disruption of physical mobility may result during sweeping operations. Can be mitigated by scheduling work during off-peak hours Health & Safety o Reduced health risks associated with water quality improvements and vector control benefits Sense of Community o Visual amenity benefits on streetscape and in urban access water bodies may enhance the sense of community Equity o Indirect impacts on special population groups would depend on the financing mechanisms proposed for implementation. In general, payment through the property tax mechanism differentially impacts low- and moderate-income groups Urban Patterns o No impacts

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.2 Control Use of Certain Chemicals (This action could be implemented as part of Actions 8.2, 8.3, 12.1, 12.2, and 12.4 of the Solid Waste Management Plan.)	To educate the user and the general public on the proper use and disposal of hazardous chemicals and to regulate the use of certain chemicals and encourage oil recycling.	County Solid Waste Management Agencies, County governments and special districts in Alameda, Marin, Santa Clara and Solano Counties, regional agencies, State Dept. of Health, and SSWMB.	Continuous	Local ordinances, State law, SB68 (1977)	Undetermined, at least $1,100	$ 1,100	Local funds RCRA, State Funds	Voluntary* SSWMB will administer SB68.

* General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS

Air Quality

- o No impacts.

Water Quality

- o Reduced amounts of toxic constituents in water bodies.
- o Reduced incidence of impaired uses (e.g. water supply) of water bodies.

Physical Resources

- o Reduced risks of fish kills, exposure of plant and animal species to harmful substances.
- o Regulation of chemicals used in agricultural production processes, timber management programs etc. may adversely affect use of the resource base. May be mitigated by alternatives such as organic fertilizers and biolocial pes- controls.
- o See also Hazardous Waste Assessment of Solid Waste Management Recommendations.

Energy

- o Reduced use of energy intensive chemicals would not appreciably affect energy demand or supply.

Amenities

- o No impacts.

INSTITUTIONAL/FINANCIAL IMPACTS

Financial

Direct Public Costs of Implementation

- o See County Surface Runoff control Plans Cost Data.

Fiscal Effects on Local Governments

- o Direct impacts on fiscal resources depend on revenue source(s) used- (See County Plans) program costs may be offset by additional taxes on sale of chemicals and distributors licenses. Control of sales may reduce or redistribute local revenues from product sales.

Institutional

- o Improved regulation and enforcement may require intergovernmental coordination.
- o Public opposition to control of chemicals may occur.
- o May require additional public agency staff to do research, public education and information, and regulation.

ECONOMIC IMPACTS

Production of Goods and Services

- o Employment- Job impacts (creation or elimination) would depend on control proposals effects on production.

Income and Investment

- o Effects on wages and salaries depends on control effects on production and thereby on employment.
- o Effects on profits depends on effects of control proposals on production (increase or decrease demand) and availability of substitute products.

Consumer Expenditures

- o Product prices may increase if added costs to producers of chemicals due to controls can be passed on to the consumer or production cost increases (e.g. food costs) are passed on.
- o Consumers may elect to reduce consumption of certain chemicals or switch to substitutes due to price increases or new information on environmental effects.

SOCIAL IMPACTS

Housing Supply

- o No impacts.

Health and Safety

- o Controls on chemical use may restrict vector and nuisance plant control program efforts or require shifts to biological controls.
- o Education on use of potentially harmful chemicals should reduce health and safety risks.

Sense of Community

- o No impacts.

Equity

- o Effects on special population groups depends on financing mechanisms and use of products subject to price increases.

Urban Patterns

- o No impacts.

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.3 Clean Stormwater Collection System	To clean catchbasins, storm drains and open channels with multiple benefit objectives e.g., water quality and flood control.	General purpose local governments (usually via the Public Works Department) and special districts in Marin, San Mateo, Solano, and Sonoma Counties.	Continuous (See Time Line)	Local ordinances	Undetermined, at least $2,800	$ 2,800	Local funds	Voluntary*

*General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
<u>Air Quality</u> o Reduced odors when accumulated debris is removed; decomposition prevented. o Temporary, localized air pollutant emission increases may occur during cleaning operations when motorized vehicles are used. <u>Water Quality</u> o Removal of accumulated solids (sediments, litter, leaves) may reduce BOD, Nitrates, Phosphates and oil and grease loads to water bodies from first flush effects of storms. o Reduced incidence of impaired uses (e.g. water supply) of water bodies. <u>Physical Resources</u> o May benefit aquatic organisms. o May impact land fill capacities where increased cleaning results in increased quantities of solids for disposal (e.g. 1 T. material/year/catch basin; open drainage channel deposits vary). <u>Energy</u> o Motorized equipment uses fuel. <u>Amenities</u> o Temporary localized noise level increases from equipment operation may be mitigated by noise abatement measures.	<u>Financial</u> Direct Public Costs of Implementation o See County Surface Runoff control Plans Cost Data. Example Costs: Catch basin Cleaning Costs $6-8/catch basin or $4-15/cu yd. Material Collected; Sewer Cleaning Costs $50-100/cu. yd. material removed. Fiscal Effects on Local Government o Direct impacts on fiscal resources depend on revenue source(s) used - See County Plans. o May be consolidated with ongoing sewer system maintenance program costs. <u>Institutional</u> o May require additional staff resources (public works personnel on short term basis and inspection, administrative personnel on long-term basis) or reallocation of resources. o May result in displacement of another public service (or level of service) during concentrated cleaning effort periods. o May result in agency staff opposition to changed work assignments and schedules and added work loads.	<u>Production of Goods and Services</u> o Employment- Creation of job opportunities in the private sector may result (e.g. engineering consultants, equipment manufacturers, monitoring and inspection personnel). <u>Income and Investment</u> o Effects on wages and salaries depend on need for additional staff to meet demand. o Increased profits may result from demand for private sector goods and services. <u>Consumer Expenditures</u> o No impacts.	<u>Housing Supply</u> o No impacts. <u>Physical Mobility</u> o Temporary, localized disruptions in physical mobility may occur during cleaning operations. May be mitigated by scheduling operations during off peak hours. <u>Health and Safety</u> o Water quality benefits may have indirect health benefits. o Cleaning activities may also benefit flood control channel maintenance. <u>Sense of Community</u> o No impacts. <u>Equity</u> o Impacts on special population groups depends on the financing mechanism(s) chosen to implement and the job benefits distribution. <u>Urban Patterns</u> o No impacts.

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.4 Control Littering (This Action could be implemented as part of Actions 1.1, 8.1 and 8.2 of the Solid Waste Management Plan.)	To develop anti-litter programs, ordinances and educate the public on the water quality impacts of litter.	Designated Solid Waste Management Agencies, local governments (including special districts) in Alameda, Marin, San Mateo, and Sonoma Counties.	Continuous	SB5; Local ordinances.	Undetermined, at least $1,100	$ 1,100	Local funds. SB650 (1977)	Voluntary* SSWMB will ensure implementation of SB5 and SB 650 (1977)

* General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Air Quality o Reduced incidences of odors associated with decomposing debris and litter in water bodies and stormwater collection systems. Water Quality o Reduced litter and organics (BOD phosphorus, nitrogen) available for introduction to stormwater system and waterbodies. o Reduced blockage of storm channels. o Reduced incidence of impaired uses (e.g., water supply) of waterbodies. Physical Resources o May indirectly benefit aquatic organisms. o Enhanced water recreation potential and use where debris and litter associated pollution impairs use. o May impact solid waste management practices - landfill capacities may be affected by added quantities of solids for disposal; may be an added incentive for recycling, neighborhood composting and other resource recovery programs. Energy o When augmenting alternative solid waste management programs, may benefit energy conservation efforts. Amenities o Visual amenity benefits of cleaner landscapes and reduced debris in waterbodies.	Financial Direct Public Costs of Implementation o See County Plans Cost Data. Fiscal Effects on Local Government o Direct impacts on fiscal resources depend on source(s) of revenue used to fund program efforts - See County Plans. o State subvention funds and fines may offset costs of enforcement and education. o Reduced amounts of litter may result in cost savings in waste collection programs. Institutional o May require intergovernmental coordination between State, regional and local government agencies and special districts. o Improved enforcement and intensified anti-litter advertising campaign may require additional staff or reallocation of agency personnel.	Production of Goods and Services o Employment - no impact expected in private sector. Income and Investment o Public employment benefits may result in increases in wages and salaries. Consumer Expenditures o No impacts.	Housing Supply o May indirectly benefit housing rehabilitation programs where litter control programs improve aesthetics of neighborhoods. Physical Mobility o No impacts. Health and Safety o Water quality improvements may have indirect health benefits. o Reduced litter may enhance vector control programs by eliminating or reducing habitats. Sense of Community o Enhanced neighborhood aesthetics may contribute to improved sense of community. Equity o Impacts on special population groups depends on financing mechanism(s) chosen to implement the program. o Where programs reduce litter and vectors with associated health benefits in areas with large concentrations of special population groups, those groups will benefit. Urban Patterns o No impacts.

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.5 Control Dumping (This Action could be implemented as part of Actions 1.1, 8.2, 8.3, 12.1, and 12.2 of the Solid Waste Management Plan.)	To enforce dumping prohibitions, develop and adopt new ordinances with multiple benefit objectives and educate the public on the broader consequences of dumping and encourage oil recycling.	County Solid Waste Management agencies, local governments (including special districts) in Alameda, Napa, San Mateo, Solano, and Santa Clara Counties.	Continuous	Local ordinances; SB5; RCRA	Undetermined, at least $30,900	$30,900		Voluntary* SSWMB and county Solid Waste enforcement agencies will enforce.

*General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS

ENVIRONMENTAL IMPACTS

Air Quality

- May reduce incidence of odors associated with decomposing debris in water bodies and stormwater collection systems

Water Quality

- Reduced amounts of debris and oil may reduce BOD, phosphates, nitrogen, suspended solids, heavy metals introduced to stormwater system and waterbodies
- Less oil would be available to leach into groundwater supplies
- Reduced incidence of impaired uses (e.g., water supply) of water bodies

Physical Resources

- May indirectly benefit aquatic organisms by removing toxic substances from the environment
- Enhance water-oriented recreation potential and use where dumping of debris and oil impairs use
- Reduced dumping could reduce quantities of solid waste which are disposed of in landfills
- Waste from re-refineries is high in concentrated metals and sulfur. Sludge created will require careful solids management

Energy

- Oil recycling may augment energy conservation efforts - 700 homes could be heated with BTU equivalent of oil currently dumped
- Recycled oil can be used to produce other energy consumptive products such as asphalt
- Re-refineries use part of waste product as fuel to power lighting and pump operations

Amenities

- Visual amenity benefits from cleaner landscape and less debris and oil slicks in water bodies

INSTITUTIONAL/FINANCIAL IMPACTS

Financial

Direct Public Costs of Implementation

- See County Surface Runoff Management Plans Cost Data

Fiscal Effects on Local Governments

- Direct impacts on fiscal resources depend on source(s) of revenue used to fund programs - See County Plans
- Reduced dumping may result in some cost and savings in public works programs (Ex. cost to remove oil dumped is $ 150/gallon)
- Fines for illegal dumping may offset costs of additional enforcement efforts
- Use of re-refined oil by public agencies would result in savings in fleet operation and maintenance costs
- Public agency oil recycling would generate revenues from sale of oil to re-refineries

Institutional

- May require additional staff resources to improve regulation and enforcement and educate public
- May require cooperation of public agencies with regulatory and program responsibilities for control of dumping and oil recycling
- May require additional regulations and guidelines to ensure proper labeling, handling and accessibility to re-refined oil

ECONOMIC IMPACTS

Production of Goods & Services

- Employment - Job opportunities may result if extensive oil recycling programs stimulate demand for more recycling firms
- Production of recycled oil may increase
- Additional firms may enter the market to meet increased demand

Income & Investment

- Increased wages and salaries may result from jobs created
- May increase profits of firms benefited by increased oil recycling (Example: (prices fluctuate with oil costs)-service stations receive 8¢/gallon, used oil collection agents - 16¢/gallon, re-refineries $1.20 - 1.60/gallon)

Consumer Expenditures

- Retail markets for re-refined oil are generally lacking. At such time as they are developed, consumers would receive the benefit of access to cost savings in purchase of re-refined oil

SOCIAL IMPACTS

Housing Supply

- No impact

Physical Mobility

- No impact

Health & Safety

- Water Quality improvements may have indirect health benefits
- Reduced dumping of debris and oil may augment vector and nuisance plant control program

Sense of Community

- Enhanced neighborhood and physical environment aesthetics may contribute to improved sense of community

Equity

- Impacts on special population groups depends on financing mechanism(s) chosen to implement the programs
- Where programs reduce dumping and aid vector control and associated public health and enhancement in areas with large concentrations of special population groups, those groups will benefit

Urban Patterns

- No impacts

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.6 Repair Streets	To ensure that water quality benefits are a consideration in street repair guidelines.	Local governments in Contra Costa and Napa Counties.	Continuous (See Time Line)	Local ordinances.	Undetermined	-0-	—	Voluntary*

*

General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
<u>Air Quality</u> o Localized increases in air emissions from repair equipment. o Reduced dust available for introduction as particulate matter. <u>Water Quality</u> o Reduced total street contaminant loads which contribute to total suspended solids, BOD and toxic substances in urban runoff. o Reduced incidence of impaired uses (e.g. water supply) of water bodies. <u>Physical Resources</u> o May indirectly benefit aquatic organisms. o May require physical resources to produce repair products. <u>Energy</u> o Repair equipment uses energy as does production of asphalt and other repair products. <u>Amenities</u> o Localized, temporary increases in noise levels during repair operations.	<u>Financial</u> Direct Public Costs of Implementation No costs above current commitments. Fiscal Effects on Local Governments o Federal and State grant subvention funds offset much of cost of street repair with remainder coming from local general revenue funds. <u>Institutional</u> o No impacts.	<u>Production of Goods and Services</u> o No impacts. <u>Income and Investment</u> o No impacts. <u>Consumer Expenditures</u> o No impacts.	<u>Housing Supply</u> o May indirectly benefit housing rehabilitation programs where street repair and maintenance improves accessability and street systems in rehabilitation areas. <u>Physical Mobility</u> o Local temporary disruption in physical mobility during repair operations. <u>Health and Safety</u> o Water quality improvements may have indirect health benefits. o Street repair programs have public safety benefits. <u>Sense of Community</u> o Streets kept in good repair may enhance neighborhood sense of community. <u>Equity</u> o No impacts <u>Urban Patterns</u> o No impacts.

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.7 Insure Proper Operation of Septic Tanks	To ensure proper operation by improved design, review and regulation.	Local and county government (and special districts) in Solano County.	Continuous	Local ordinances. Porter-Cologne Act.	Undetermined (Monitoring Cost appear under action 8.14)	-0-	Local funds.	Voluntary*

*General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

*General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
	See Impact Assessment of Policy 11		

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.8 Control Erosion	To improve efforts to control erosion from earth moving activities by establishing and enforcing ordinances and incorporating erosion considerations into construction activities	Local and county governments, usually via Public Works and Building Inspection Departments (including special districts) in Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano and Sonoma Counties, Resource Conservation Districts.	Continuous	Local ordinances	Undetermined, at least $99,100	$99,100	Local funds	Voluntary*
	*General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.							
Action 8.9 Improve Agricultural Practices	To examine and improve agricultural and range management practices to ensure consideration of surface runoff. To develop land management plans with aid of Resource Conservation Districts	Resource Conservation Districts, Farm Bureaus and county governments in Marin, Napa, Santa Clara, Solano and Sonoma Counties.	Continuous	Local ordinances, State and Federal laws	Undetermined	Included in 8.9 costs	Local, State and Federal funds	Voluntary*
	*General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.							

ENVIRONMENTAL IMPACTS

Air Quality

- Localized reductions in dust/particulate matter from construction activities.

Water Quality

- Reduced amounts of sediments and nutrients entering waterbodies from agricultural and construction activities.
- Reduced siltation of stream channels, lakes and reservoirs and annual sediment loadings to the Bay contributed by land disruption by human activities.
- Reduced turbidity, algae blooms, and oxygen depletion in streams, lakes and reservoirs.
- Reduced incidence of impaired use (e.g., water supply) of waterbodies.
- Reduced amounts of suspended solids available for chemical, pesticide and heavy metal binding.

Physical Resources

- Reduced incidence of burial of aquatic bottom organisms and fish kills may result.
- Indirectly benefits productivity of aquatic community by preventing or reducing interference with photosynthesis, elimination of food sources.
- Reduced losses of productive topsoil, organic matter should enhance the productivity of agriculture and timber production activities.
- May indirectly enhance recreation potential and use of waterbodies and adjacent lands.

Energy

- May indirectly result in energy savings where dredging activities are reduced.

Amenities

- Visual amenity benefits of less turbid waters and reduced eroded areas.
- Visual amenity benefits of preserving the natural state of the environment.

INSTITUTIONAL/FINANCIAL IMPACTS

Financial

Direct Public Costs of Implementation

- See County Surface Runoff control Plans Cost Data.
- See Council of Bay Area Resource Conservation Districts Handbook of Best Management Practices for example costs.

Fiscal Effects on Local Governments

- Direct impacts on fiscal resources depend on revenue source(s) used - See County Plans.
- Permit and plan review fees may offset local costs to implement and enforce.
- Performance bonds may offset costs of clean-up.
- Savings in operation and maintenance costs (e.g., in reservoirs) of local governments and special districts may result - an estimated $5 million is spent annually to alleviate lake problems such as siltation, algae blooms, aquatic weeds, fish kills, etc.

Institutional

- Effective implementation would require the cooperation of numerous public agencies such as National Park Services, U. S. Geological Survey, Corps of Engineers, California Department of Fish & Game, Flood Control and Water Districts, cities and counties.
- New or amended ordinances, regulations or administrative rulemaking may be required.
- Some aspects of erosion control programs may meet with public opposition.
- Additional staff resources may be required to implement and enforce the recommendations.

ECONOMIC IMPACTS

Production of Goods and Services

- Employment - Creation of job opportunities may result (e.g., landscape and engineering consultants, construction firms).
- Increased demand for goods and services may result in some new firms entering market.

Income and Investment

- Effects on wages and salaries depends on control measures effects on production and employment.
- Increased profits for firms benefiting from increased demand for goods and services.
- Profit of firms and individuals bearing costs of controls should not be affected assuming costs can and will be passed on to the consumer (industry dependent response).

Consumer Expenditures

- Where private industry costs to control erosion are passed on in product prices, costs of goods and services will increase.

Direct Private Costs of Implementation

Example Costs of Erosion Control and Agricultural Management Practices:

Hydroseeding/Hydromulching
$425-900/acre

Siltation Berm
$7.33/lineal foot

Waterway Fencing
$1-2.75/lineal foot

Range Seeding
$18/acre

Construction erosion controls for 80 unit subdivision may cost $500-700/acre.

SOCIAL IMPACTS

Housing Supply

- Decreased supply (e.g., < 2DU/acre instead of ≤ 4DU/acre on slopes ≥ 15%) and increased costs of housing (e.g., the average price of a house may increase $200-600 - an example design and installation cost of a best management practice) may result where erosion controls are a new component of the development approval process.

Physical Mobility

- Localized, temporary disruption in physical mobility during construction activities.

Health and Safety

- Indirect public safety benefits of reduced flood peaks and flood risks associated with siltation and alteration of natural flow regimes in streams.
- Reduced erosion and mudslide risks.
- Reduced likelihood of development in hazardous areas with attendant public safety benefits.
- Reduced conditions conducive to propagation of vectors and other noxious plant and animal species.
- Retention or debris basins may become a health hazard if water stagnates and vector problems result or a safety hazard (drowning).

Sense of Community

- No impacts.

Equity

- Indirect impacts on special population groups depends on financing mechanism(s) proposed as well as actual impacts on housing supply and costs.

Urban Patterns

- Erosion control requirements should not in and of themselves affect urban patterns.

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.10 Divert Runoff from Contaminated Areas	Prohibit flushing of materials from impervious surfaces. * General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.	Local & county governments (including special districts) in Alameda, Marin, Solano and Sonoma Counties.	Continuous	Local Ordinances.	Undetermined, at least $2,700	$ 2,700	Local funds	Voluntary*
Action 8.11 Treat and Store Runoff	Construct treatment facilities to replace septic tanks; investigate sewer line infiltration and exfiltration problems; impound and/or treat runoff as last resort. * General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.	Local and county governments (including special districts) in Napa, Santa Clara and Sonoma Counties.	Continuous	1973 Amendments to the Water Pollution Control Act, Porter-Cologne Act, local ordinances.	Undetermined	-0-	Local funds, Federal and State grants	Voluntary*
Action 8.12 Control Land Use	Develop creekside buffer strip requirements, establish performance standards for development in sensitive areas. * General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.	Local and county governments (including special districts) in Alameda, Marin, Santa Clara, and Solano Counties.	Continuous	Local Ordinances.	Undetermined, at least $1,500	$ 1,500	Local funds	Voluntary*
Action 8.13 Establish Water Quality Monitoring Program	Establish continuous monitoring programs, sample to find cause of specific problems, monitor effectiveness of control practices.	Local and county governments (including special districts) in Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties.	Continuous	Local Ordinances, State Law.	Undetermined, at least $40,100	$40,100	Local, State and Federal funds	Voluntary*

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Impacts same as noted for Action 8.5 (Control Dumping).	Impacts same as noted for Action 8.5 (Control Dumping).	Impacts same as noted for Action 8.5 (Control Dumping).	Impacts same as noted for Action 8.5 (Control Dumping).
See Impact Assessment for Policy 5 of the Water Quality Management Plan (Provide Facilities Needed for Municipal Sewerage Service and Water Quality Protection			
Impacts same as noted for Actions 8.5 and 8.9.	Impacts same as noted for Actions 8.5 and 8.9.	Impacts same as noted for Actions 8.5 and 8.9.	Impacts same as noted for Actions 8.5 and 8.9.
<u>Air Quality</u> o No impacts <u>Water Quality</u> o Indirectly improves water quality - provides data to make informed decisions <u>Physical Resources</u> o Indirectly benefits physical resources as water quality and land management practices improve <u>Energy</u> o No impacts <u>Amenities</u> o Indirectly affects amenities - highly dependent on nature of actions taken as a result of monitoring data	<u>Financial</u> Direct Public Costs of Implementation o See County Surface Runoff control Plans Cost Data Fiscal Effects on Local Governments o Direct impacts on fiscal resources depend on revenue source(s) used - See County Plans o Cost savings may result where monitoring consolidation occurs <u>Institutional</u> o May require additional staff to increase monitoring activities o Would require cooperation and coordination among the numerous agencies involved in water quality monitoring	<u>Production of Goods & Services</u> o Employment - may create employment for sampling and analysis personnel in public and private laboratories <u>Income & Investment</u> o Will require capital investment for sampling and analysis when that is a new function for a management agency and is not contracted to private firms <u>Consumer Expenditures</u> o No impacts	<u>Housing Supply</u> o No impacts <u>Physical Mobility</u> o No impacts <u>Health & Safety</u> o Indirectly would benefit public health through water quality improvements o Could uncover health and safety problems meriting solution <u>Sense of Community</u> o No impact <u>Equity</u> o No impact <u>Urban Patterns</u> o No impact

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.14 Establish a public education/information program (This Action could be implemented as part of Actions 8.2 and 8.3 of the Solid Waste Management Plan.)	Educate public to water quality impacts of dumping, littering, use of certain chemicals, construction, etc. Educate and promote recycling and proper disposal of wastes.	County Solid Waste Management agencies, Local & county governments (including special districts) in Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties, ABAG.	Oct. 1977-1983	Local ordinances; SB5; SB650 (1977)	Undetermined, at least $15,500	$15,500	Local and State funds. SB650 (1977)	Voluntary* SSWMB will enforce SB5 and SB650

*General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Impacts same as noted for Action 8.14 (Establish Water Quality Monitoring Program).	Impacts same as noted for Action 8.14 (Establish Water Quality Monitoring Program).	Impacts same as noted for Action 8.14 (Establish Water Quality Monitoring Program).	<u>Sense of Community</u> o Public education/information programs about surface runoff problems and solutions could indirectly improve the sense of community. Other impacts are same as noted for Action 8.14.

RECOMMENDATIONS	GENERAL DESCRIPTION	IMPLEMENTING AGENCY (OR AGENCIES)	SCHEDULE FOR ACTION	LEGAL AUTHORITY	TOTAL COST/YEAR OF RECOMMENDED ACTION	PORTION OF TOTAL COST/YR. DIRECTLY ATTRIBUTABLE TO THIS PLAN	FINANCING MECHANISM	MEASURES TO ENSURE IMPLEMENTATION
Action 8.15 Establish a surface runoff administrative structure and procedures for Continuing Planning	Establish a coordinating body, advisory committee and procedures to annual review and update of plan. Document existing practices and local agency actions to implement plan. Determine cost and financing mechanisms for annual work programs; investigate non-local funding sources.	Local and county governments (including special districts) in Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties.	Oct. 1977-1983	Local ordinances, State Law.	Undetermined, at least $36,000	$36,000	Local funds.	
	General enforcement authority for local programs affecting surface water quality may be exercised by the Environmental Protection Agency and the State Water Resources Control Board acting through the Regional Water Quality Control Board.							

ENVIRONMENTAL IMPACTS	INSTITUTIONAL/FINANCIAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS
Air Quality o May indirectly benefit air quality when surface runoff management coordinates with air quality protection measures. Water Quality o Indirect improvements in water quality as data, information and plans improve decision-making about surface runoff management. Physical Resources o Indirect benefits to aquatic resources as overall water quality improves. o Indirect benefits of enhanced recreation potential and use from improved water quality and land management. Energy o Surface runoff management practices may use energy; others may reduce use of energy by substituting management controls for energy consumptive structural controls. Amenities o Indirect improvement of land and water visual amenities and natural state of environment.	Financial Direct Costs of Implementation o See County Surface Runoff Management Plans Cost Data ABAG Costs - Fiscal Effects on Local Governments o Depends on source(s) of revenue used - See County Plans. Institutional o Requires aggressive leadership by County 208 lead agency staff. o Requires involvement and cooperation of numerous agencies.	Production of Goods and Services o Employment- Jobs may be rented to carry out and meet new requirements if developed in the CPP. Income and Investment o May indirectly increase or decrease profits of firms affected by new requirements if developed in the CPP. Consumer Exepnditures o Prices of goods and services may increase if new requirements are developed in the CPP.	Housing Supply o May indirectly affect the supply and cost of housing if new requirements result from the CPP which affect housing. Physical Mobility o Localized short-term disruption in physical mobility where controls noted to have mobility impacts (Policy 1-17) are continued. Health and Safety o Indirect health benefits from water quality improvements. Sense of Community o May indirectly affect the sense of community depending on recommendations of CPP. Equity o Impacts on special population groups depends on financing mechanism(s) proposed and effects of CPP proposals and findings on housing and jobs. Incidence analysis should be one review requirement of a program to develop financing mechanisms. Urban Patterns o May indirectly affect land use.

The recommended control measures are expected to have a variety of benefits. Specific benefits include positive impacts on water quality problems associated with oxygen depletion, toxic materials, high bacteria and virus concentrations. These should improve the situation for shellfish harvesting, commercial and sport fishing, fish migration and spawning. Enhanced wildlife habitat benefits are also expected. Another effect of water quality improvements is the increased potential for water contact and non-contact recreation. Practices which result in reduced losses of valuable topsoil may benefit the agriculture and silviculture resource base.

Several of the Best Management Practices may affect solid waste management practices in the region by reducing to some degree the amount of materials requiring disposal in sanitary landfills. Other practices may contribute to the new emphasis on resource recovery and recycling but will also require careful handling of waste residuals.

While several of the Best Management Practices involve the use of machinery, the energy use effects are not expected to be substantial. Other practices may indirectly reduce energy use to some extent. Reducing erosion should affect energy consumptive activities such as dredging and clearing. Recycling or reusing waste materials should have positive effects from the energy and conservation standpoint.

Reducing or eliminating debris, litter and oil in water bodies and reducing erosion should result in improvements in the visual quality of the region's waters and landscape.

5. Institutional and Financial Impacts

A summary of the institutional and financial impacts appears in Table 7. The cumulative institutional and financial impacts of the Surface Runoff Management Plan are summarized as follows.

The exact effect on the fiscal resources of local governments depends upon the financing mechanism(s) chosen to implement the specific actions recommended. In general, because most of the recommendations are premised on low cost approaches to Surface Runoff Management, the net fiscal effects should not be great. Recommendations which do involve actions over and above current program activities could be financed without adversely impacting the fiscal resource base (e.g., through permit fees, performance bonds, fines, etc.). In several cases, a positive effect on fiscal resources may occur when surface runoff management practices reduce costs incurred to mitigate problems caused, in part, by surface runoff. For example, an estimated $5 to 10 million is spent annually by various public works agencies to alleviate problems such as siltation, algae blooms, aquatic weeds and fishkills.

Effective implementation of the Surface Runoff Management Plan will require the cooperation of numerous public agencies. New or amended ordinances and regulations may be required and additional staff resources

may be necessary to improve enforcement and program performance. For the most part, the Best Management Practices recognize the substantial efforts currently being taken by local governments and seek to incorporate water quality considerations into their objectives. Multiple benefits and the potential for efficiency gains and cost savings are other benefits expected from the plan.

6. Economic Impacts

A summary of the economic impacts appears also in Table 7. The cumulative economic impacts of the Surface Runoff Management Plan are summarized below.

The employment effects of the plan cannot be stated with certainty. Some requirements may stimulate demand for certain products and services of the private market. That increased demand may result in new firms entering the market place and/or increased production, either of which could create job opportunities. Jobs created might occur in consulting firms, contracting or construction trades, administration, and other service sector areas.

Profits of firms benefiting from the increased demand for their goods and services may increase. Profits of firms bearing costs of requirements should not be affected assuming costs can and will be passed on to the consumer. The actual effect depends on the industry but the plan is not likely to result in firms going out of business.

Consumer expenditures may be affected when the costs of requirements are passed on as product or service price increases.

7. Social Impacts

A summary of social impacts of actions recommended appears in Table 7. The cumulative social effects of the Surface Runoff Management Plan are summarized below:

Impacts on the supply and cost of housing cannot be estimated with certainty. Those Best Management Practices requiring new or additional controls on and during construction may affect both supply and cost. However, the net effect on the price of housing is not expected to be significant. Some controls may benefit housing rehabilitation and housing values somewhat by enhancing neighborhoods from an aesthetic standpoint. It is expected that neighborhoods where actions are implemented may experience some improvements in the sense of community or community pride, where aesthetics are enhanced and cooperation occurs to effect neighborhood programs such as composting.

Plan recommendations are expected to have significant effects on public health and safety. Water quality actions are premised in large part on public health considerations. Improvements are expected in conditions that contribute to health risks such as mosquito and other vector propagation. In addition, several recommendations may reduce flood risks and severe erosion and mudslide risks.

The indirect impacts on special population groups depend in large part on the choice of financing mechanisms to implement plan recommendations as well as housing supply and cost impact and the beneficiaries of job opportunities resulting from the plan. The impacts will vary. Some actions will have positive effects, others negative. Jurisdictions carrying out the plan and agencies participating in the Continuing Planning Process will need to be sensitive to the question "who benefits and who pays" as they work together to manage surface runoff.

For the most part, urban patterns will not be affected by surface runoff plan recommendations. Localized impacts may occur where the timing, density or location of development is a consideration of effective implementation. However, it must be stressed that many of the actions are already a part of local governments' operations.

G. PLAN IMPLEMENTATION AND ENFORCEMENT

One of the most important aspects of the Surface Runoff Management Plan concerns the governmental and financing arrangements for implementation of the proposed control measures. These include enforcement mechanisms to ensure that the plan is carried out and mechanisms for monitoring implementation and updating the plan on a regular basis.

This section summarizes the portions of county plans which deal with implementation and enforcement. In addition, regional aspects of plan implementation and enforcement are also discussed.

1. Implementation of the Plan

The county surface runoff management plans are for the most part based on existing practices. For example, street sweeping, litter control and stormwater collection system cleaning are all programs currently underway. The plans in many cases recommend that these programs be modified, but this does not change the fact that the plans build on the present system rather than suggesting major modifications.

To the extent that present practices are used to provide a baseline for each county's surface runoff plan, therefore, the existing agencies can implement the plan. Nowhere in the plan is a need specified to transfer surface runoff programs from one agency to another - or to create a new agency for such purposes. The county plans reflect the concept that existing government can do the job.

Implementing agencies are largely at the local government level. This means that surface runoff management programs will be operated mostly by the region's cities, counties, and special districts. City and county responsibilities will continue to be held by several departments, most important among which are their public works, health, and planning units. Special districts will implement those portions of the plan consistent with specific statutory mandates.

Local programs with their agency designations are as follows:

- Improve street sweeping - Local public works departments.
- Control use of certain chemicals - public works departments and local agricultural agencies. The county plans also suggest the important role of state government in this program.
- Clean stormwater collection systems - local public works and flood control departments.
- Control littering - health and safety units, including city police and county sheriff departments.

- o Control dumping - public works and health departments. County solid waste management agencies may have a role to play.

- o Insure proper operation of septic tanks - county health departments.

- o Control erosion - local building and public works departments, planning departments and the Resource Conservation Districts.

- o Improve agricultural practices - local agricultural agencies, including the Resource Conservation Districts.

- o Divert runoff from contaminated areas - local public works and flood control departments.

- o Measures to control land use - local planning departments.

- o Establish a public education/information program - local school districts and general purpose governments.

Other than implementing specific control measures, the county plans provide administrative structures to update and continue the planning. In most cases, the county lead agency responsible for preparing the initial plan is designated to be the agency for continuing planning. In a few instances, however, all that is specified is the process for selecting the agency.

At the local level of government, plan implementation relies heavily on existing agencies of local government. At the regional level, plan implementation will also involve ABAG, the agency responsible for coordinating the initial plan. ABAG's major plan implementation functions are described in Section E under Plan Recommendations for Regional Implementation.

2. Financing

Most of the county surface runoff management plans are relatively inexpensive during the initial stages of implementation. This reflects the commonly held opinion among county staff that problems and solutions need more careful definition before massive outlays can be justified. At the same time, therefore, many of the plans propose more costly controls later during the implementation period if initial efforts are not satisfactory in solving perceived problems.

Costs are kept down because the county plans stress the concept of Best Management practices. One example of this is in street sweeping. Neighboring jurisdictions can coordinate their street sweeping efforts, and if they thereby consolidate their investment in expensive equipment, it will result in reduced expenditures.

Most costs arising from the county plans are to be paid for out of local funds. Since the majority of controls involve the implementation or continuation of local programs, it is appropriate that they be financed locally. More expensive local items - vacuum sweepers e.g., - might be subsidized out of federal revenue sharing funds, but the bulk of costs is borne locally.

Two counties have developed surface runoff plans which rely more heavily on outside sources of funds. One is San Francisco's plan, which was not prepared as part of the current surface runoff planning effort. San Francisco's situation is substantially different than elsewhere in the Bay Area because it has a combined stormwater and sanitary sewer system. This fact means that surface runoff will need to be collected, stored, treated and disposed. A massive construction program with a cost now estimated at greater than $1.25 billion is being undertaken to provide the facilities necessary to handle both municipal effluent and surface runoff. Federal and State grants will cover up to 87½ percent of the construction costs, and local bonds will provide the remaining portion. Operation and maintenance costs of the system will be paid for out of local revenues.

Alameda County's plan also requires infusion of outside funds for implementation. Alameda's requirements, however, are relatively minor in comparison to San Francisco's. Alameda has taken the position that its problems can be solved by increasing the level of certain services that it has identified and scheduled in its plan. Implementation of these service levels, though, depends on receipt of federal and/or State funds. Alameda's plan is different than Sonoma County's, for example, which calls for such projects only if locally funded controls taken during the first few years do not work. The remaining plans do not rely substantially on outside funds at all.

3. Enforcement

- *Initial Plan Implementation.* During the first two years, all of the county plans discuss the need for an enforcement mechanism to ensure that they will be implemented as specified. The mechanism which has been agreed to is as follows.

  The plans will essentially be self-enforcing during the first two years following EPA approval. It will be the responsibility of cities, special districts and the county to implement their portions of that county's plan. In other words, compliance will be voluntary.

  The lead agency for implementing the county plan will track implementation within the county. If there is non-compliance within the first two years, the lead agency will negotiate such matters with the offending jurisdiction.

The San Francisco Bay Regional Water Quality Control Board will monitor implementation progress, noting all instances of compliance and non-compliance. This process will assist the Regional Board in determining if further enforcement will be necessary after the initial two year period. Because of its responsibility to update the plan, ABAG will also track implementation, working closely with the Regional Board.

o *The Continuing Planning Process:* After two years, the Regional Board may decide to enforce the plan. Presently, it has enforcement authority for surface runoff programs that it has elected not to use for the time being.

These powers are based on both federal and State law. The 1972 Amendments to the Federal Water Pollution Control Act, Public Law 92-500, have recently been judicially interpreted as requiring the U.S. Environmental Protection Agency to issue waste discharge permits for stormwater discharges. This court ruling is quite new, and EPA has not yet decided what form these permits will take. One possibility is that they could include discharge standards and compliance schedules for cleanup. Pursuant to federal and State procedure, the Regional Board would be given the authority to administer this program in the Bay Area. This means that the Regional Board could dictate how local jurisdictions would operate local programs so that compliance with such standards and schedules could be achieved.

State law also operates to give the Regional Board such authority. Under the Porter-Cologne Act, the State Water Resources Control Board, acting through the Regional Board, has the power to do whatever it deems necessary to implement water quality standards applicable to given bodies of water. If water quality standards in the Bay Area cannot be met unless programs are implemented to clean up the region's surface runoff, the Regional Board would have the authority to tell local jurisdictions how to run their programs affecting surface water quality.

Given these tools, the Regional Board currently has adequate legal authority to enforce the surface runoff plan. However, it may not be necessary or desirable for the Regional Board to do so. If satisfactory progress towards implementing the plan and neutralizing any surface runoff problems is made during the first two years, the plan will continue with voluntary self-enforcement by the region's local jurisdictions. If on the other hand, progress is unsatisfactory after two years the Regional Board may elect to step in and enforce the plan.

Regional enforcement is only a possibility now and during the two years following plan approval. The details of such a move have not been worked out. ABAG, local governments and the Regional Board should work jointly to make any such determinations.

H. OTHER OPTIONS NOT INCLUDED IN THE PLAN

The Surface Runoff Management Plan was developed under tremendous time constraints. One of the consequences was that the control measure selection period overlapped that of problem identification (See Figure 1). This resulted in the selection of the surface runoff control measures being essentially a process of elimination. Criteria used by the counties in choosing acceptable control measures included the following:

- cost/effectiveness
- ability of existing agencies to implement the measures
- social/economic acceptability
- time involved in implementing control measure
- feasibility for modifications as new information becomes available

Table 8 presents surface runoff control measures which the counties were required to consider as part of their plans. An "X" appearing in the "YES" column indicates that the control measure appears in at least one county surface runoff plan. An "X" in the "NO" column means that the control measure is not applied in any county plan, and a "MAYBE" indicates that the control measure is to be considered in the future. The comment column provides an explanation of why the "NO's" and the "MAYBE's" were not included in the initial plans. Review of this table shows that most of the control measures considered in plan development are being implemented by one or more counties. A more detailed description of all control measures shown in the "YES" column can be found in the individual county plans (Volume V of EMP) and in the regional summary of the surface runoff plan.

TABLE 8.

OTHER OPTIONS NOT INCLUDED IN THE PLAN

CANDIDATE SURFACE RUN-OFF CONTROL MEASURES	CONTROL MEASURE DESCRIPTION	IS CONTROL MEASURE APPLIED IN PLAN? YES	NO	MAYBE	COMMENTS
MEASURES TO REDUCE ACCUMULATION OF POLLUTANTS PRIOR TO RUNOFF					
1. Provide more frequent street cleaning	Make better use of existing equipment or increaseing number of sweepers	X			
2. Provide more efficient methods of street cleaning	Increase operator training, adjusting equipment to focus on fine dirt particles	X			All counties making improvements in street sweeping operations
3. Repair streets	Patching and restoring street surfaces	X			One county is including the consideration of water quality benefits of street repair in their decision-making process
4. Control certain chemicals	Control use of dangerous chemicals especially pesticides	X			Implemented by four counties for both agriculture and residences
5. Restrict auto parking	Restrict auto parking to increase street sweeper effectiveness	X			
6. Control use of lots and streets	Use laws, ordinances or programs to reduce accumulation of litter and wastes on unused parcels		X		Difficult to enforce. If a problem develops, stronger enforcement will be considered
7. Control dumping	Prohibit dumping of wastes on lots and streets	X			Many ordinances exist, but require stronger enforcement
8. Control littering and dog droppings	Encourage and enforce proper disposal of solid wastes and domestic animal wastes	X			
9. Control automobile and other emissions	Many automobile emissions ultimately are deposited on surfaces and washed into receiving waters		X		Recommended for regulation by State and federal governments. Included as part of public education and recycling programs.
10. Control direct discharge of pollutants	Control dumping of motor oil, paints and dangerous chemicals into storm drains	X			Education programs needed to discourage dumping into storm drains
11. Clean storm water collection system	Strategically clean accumulated leaves, debris and sediment in catch basins and stream channels	X			Three counties increasing activities in this area
12. Replace cross connections of sewerage systems	Separate storm drain system and sewer system so that overflows into storm drain system do not carry sewage	X			If cross connections are found to exist, control should be considered as an alternative to sewage treatment for increasing capacity

TABLE 8. (Continued)

CANDIDATE SURFACE RUN-OFF CONTROL MEASURES	CONTROL MEASURE DESCRIPTION	IS CONTROL MEASURE APPLIED IN PLAN? YES	NO	MAYBE	COMMENTS
13. Insure proper operation of septic tanks and leach fields	Provide for proper review, inspection and maintenance of septic systems	X			Also addressed by Miscellaneous Sources Management Plan
MEASURES TO CONTROL LAND USE					
14. Develop slope-density standards	Limit the development of hillside areas thereby reducing the amount of erosion and volume of runoff		X		Several kinds of local ordinances already exist. Cities without such ordinances are located on flat terrain or their hillsides are completely developed
15. Maintain open space areas	Concentration of urban development to minimize the impervious land surface increasing infiltration		X		Considered economically prohibitive at this point
16. Control development patterns	Direct growth towards areas which are less likely to produce pollution problems		X		Land use development patterns considered as control measures in the Air Quality Maintenance Plan
17. Develop buffer strip requirements	Maintain open areas surrounding developments or along stream channels to increase infiltration and decrease erosion	X			Two counties are developing streambank ordinances. Many other local jurisdictions already have these
MEASURES TO REDUCE AMOUNT OF POLLUTANTS AND THE PEAK FLOW OR VOLUME OF RUNOFF					
18. Control roof drains		X			To be implemented in the continuing planning process by one county
19. Construct rooftop detention and storage	Temporarily store rain water on rooftops and release after period of peak storm runoff		X		Refitting existing buildings very costly. No information that water quality benefits would result
20. Rechannel runoff to prevent flow over critical surfaces	Use of channels and berms to divert runoff away from contaminated areas	X			
21. Redesign curb and gutter configurations	Redesign curbs and gutters to alter the timing of urban stormwater runoff		X		Retarding flow to reduce peaks is best achieved by other means
22. Remove debris in channels, pipes and inlets to improve flow	Remove debris to prevent constructions and storm sewer overflow	X			

CANDIDATE SURFACE RUN-OFF CONTROL MEASURES	CONTROL MEASURE DESCRIPTION	IS CONTROL MEASURE APPLIED IN PLAN? YES	NO	MAYBE	COMMENTS
MEASURES TO REDUCE AMOUNT OF POLLUTANTS AND THE PEAK FLOW OR VOLUME OF RUNOFF (continued)					
23. Regrade disturbed areas	Regrade slopes of bare soil thus reducing erosion	X			
24. Reseed or apply vegetative cover to bare slopes	Reestablishing vegetative cover to reduce erosion	X			All counties are implementing some form(s) of erosion control(s)
25. Stabilize channels of rivers and streams	Construct drop structures or line channels to prevent streambank erosion	X			
26. Control erosion at construction sites	Use of straw mulch soil binders and other measures	X			
27. Regulate construction schedules to avoid concentration in time or space	Restrict construction to dry periods to aviod leaving bare soil during storm season		X		Prevention of erosion during construction can be controlled using more acceptable means
28. Construct permanent berms for critical sources	Construct permanent stormwater diversions for sources such as gas stations, feedlots, recycling areas			X	Permanent berms already being used for feedlots. Urban application dependent on need
29. Use energy dissipators to reduce potential for erosion or transport of solids	Use of drop structures and other measures to prevent channel erosion	X			
30. Increase perviousness of surfaces	Use of porous pavement and other techniques to increase infiltration		X		Use of porous pavement still in experimental phase. Effectiveness not yet demonstrated
31. Require minimum amount of pervious surfaces for new construction	Require new construction projects to maintain a certain percent of the land to be pervious	X			
32. Use efficient tillage and plowing practices for agriculture	Use of rural Best Management Practices advocated by Resource Conservation Districts	X			
33. Modify drainage basin	Modification of watershed to change routing of surface runoff		X		Environmental and economic impacts considered undesirable
MEASURES TO TREAT AND STORE RUNOFF					
34. Trap sediment and solids by use of catch basins	Construction of catch basins in storm drain system to collect sediment and debris		X		Catch basins require periodic cleaning. Effectiveness is considered marginal

TABLE 8. (Continued)

CANDIDATE SURFACE RUN-OFF CONTROL MEASURES	CONTROL MEASURE DESCRIPTION	IS CONTROL MEASURE APPLIED IN PLAN? YES	NO	MAYBE	COMMENTS
MEASURES TO TREAT AND STORE RUNOFF (continued)					
35. Impound runoff in upstream channels	Collect runoff in upper end of watershed to reduce peak storm water flow			X	For future consideration if other measures prove ineffective
36. Construct on-line or off-line storage	Construction of above-ground or below-ground storage facilities for temporary storage of peak storm flow			X	"
37. Use existing capacity of storm sewers for storage of flows	Provide centralized control of regulator and pumping stations for temporary storage of storm runoff			X	"
38. Construct treatment facilities	Construct facilities similar to sewage treatment plants to collect and treat surface runoff	X			To replace faulty septic tank system
39. Use capacity at existing treatment plants	Use any extra available treatment plant capacity to treat a portion of the surface runoff			X	
40. Prevent direct discharge of storm water into receiving waters	Routing treated or untreated storm waters to artificial lakes or irrigation ponds		X		Requires major modifications of drainage system. Costs considered prohibitive at this point

PL 92-500

208

FINAL DRAFT REPORT

SURFACE RUNOFF MANAGEMENT PLAN FOR ALAMEDA COUNTY

ALAMEDA COUNTY FLOOD CONTROL

AND WATER CONSERVATION DISTRICT

SEPTEMBER 30, 1977

OVERVIEW

Congress demonstrated concern for the pollutant characteristics of surface water runoff as a constraint to the national goal of clean water when they passed the Clean Water Act of 1972 (i.e., Public Law 92-500). Section 208 of this law mandates areawide management planning to control surface runoff pollution. The Alameda County Surface Runoff Management Plan (SRMP) will become a part of the Regional Surface Runoff Management Plan as one element of the Bay Area's regional Environmental Management Plan (EMP). The intent of Alameda County's Surface Runoff Management Plan is to organize the collective efforts within the County to reach a balanced solution to this pollution problem. Surface water quality investigations conducted by the County since 1972 and the recent 208 investigations of urban stormwater runoff have verified the existence of substantial and widespread pollution of local interior waters. The major problems identified with surface runoff are erosion/sedimentation and bacteria. Other identified concerns include toxic heavy metals, litter, organic matter, and algal nutrients. The significant sources of these contaminants are land disturbances, both natural and man-made; animals and sanitary sewage; concentrated traffic activity on streets and highways; illegal dumping and littering activity. To establish a process to manage these sources, the Surface Runoff Management Plan is divided into two parts. The purpose of phase one--i.e., the initial plan--is to begin a surface runoff quality management effort. This is implemented in the initial plan by establishing responsibility for surface runoff management planning within an existing agency and identifying those agencies with implementation action responsibilities. The purpose of phase two--i.e., the continuing planning process--is to investigate primarily non-local financing for management practices which may lead to future implementation projects. Recommended Best Management Practices (BMP's) (i.e., non-structural, source control measures) include street cleaning, drainage system cleaning and revisions of existing erosion control ordinances. In general, these BMP's are existing activities augmented by improvement of existing urban hygiene services (e.g., street cleaning and inlet and drainage channel cleaning). On agricultural lands, additional investigation with the agricultural agencies is proposed to develop land management plans to mitigate erosion problems. Some BMP implementation costs (urban and rural) are significant yet not nearly as costly as end-of-pipe (i.e., structural) treatment. However, existing service levels are in jeopardy of cutbacks due to budget pressures on property tax revenues. Maintenance of existing service levels of BMP's or even existing budget levels is strongly recommended. Financing arrangements for improved BMP's have not been secured. A major work item is to investigate non-local funding (one local financing possibility is discussed herein). An environmental impact assessment summary of recommended control measures is also included. Enforcement of the management plan would be achieved primarily at the regional level through the NPDES permit system and the A-95 Review process. Implementation of the SRMP will provide distinct multiple benefits. These advantages are in the categories of: (1) economic utility, (2) recreation, (3) earlier results and lower costs than structural end-of-pipe treatment, (4) mosquito abatement, (5) reduction of flood hazards, and (6) an overall cleaner environment. Citizen recommendations from the Citizen's Advisory Committee are included and the preface to their recommendation states that: The Committee unanimously endorses and is committed to the basic concepts and goals put forward in the Surface Runoff Management Plan, namely, the attainment of cleaner water for the County.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

SUPPORT DOCUMENTS

Existing Problem Report

Future Problem Report

Data Collection Summaries from Glen Echo and Castro Valley Creeks

Corps of Engineers' Upper Alameda Creek Urban Study

Street Sweeping Experiment Report

Woodward/Clyde Consultant's Analysis and Control Descriptions

Water Quality Monitoring Plan

Castro Valley Demonstration Grant Request

LIST OF TABLES

I. SURFACE RUNOFF MANAGEMENT PLAN SUMMARY

Background and Review Process

In 1972, Congress passed the Federal Clean Water Act Amendments, (Public Law 92-500). Section 208 of the Act calls for designated areas to develop a plan, and establish a planning process to control water pollution. The San Francisco Bay Region was designated a "208" area and the Regional Planning Agency, the Association of Bay Area Governments (ABAG), was awarded a $4.3 million grant for this study in 1976. ABAG decided to extend the scope of the study to include air pollution and solid waste management plans along with water quality plans to create a comprehensive Environmental Management Plan (EMP). The plan herein described is just one element of the EMP. ABAG negotiated a contract with the Alameda County Flood Control and Water Conservation District (ACFC&WCD) to produce a county-wide surface runoff management plan for Alameda County. Similar contracts were negotiated with each of the other seven Bay Area counties; San Francisco being excluded from developing a surface runoff plan because of their current solution to treating combined storm and sanitary flows. The county plans will be integrated into a Regional Surface Runoff Management Plan (SRMP). The focus of this plan is the control and reduction of surface runoff pollutants.

The purpose of the Surface Runoff Management Plan is twofold. The first purpose is to satisfy the surface runoff planning requirements of the 1972 Federal Water Pollution Control Act Amendments Public Law 92-500. The second purpose is to improve the quality of surface runoff waters throughout the San Francisco Bay Area and to reduce the pollutant loadings to interior waters and the Bay.

A final draft of the County plan is to be submitted to ABAG by the Board of Supervisors by October 12, 1977. Following Alameda and other counties' submittals in October, 1977, the local plans will be integrated by April 1978 into a Regional Surface Runoff Management Plan and combined into the comprehensive Environmental Management Plan being prepared by ABAG. During this time period, ABAG's draft EMP (including Alameda County's SRMP) will be reviewed by each locally affected jurisdiction and the public. Resultant changes will then be incorporated and the EMP will be voted on for adoption by ABAG's General Assembly in April 1978. Each member government will have one vote in the General Assembly, then the EMP must go through another approval process at the state and federal level. Negotiations are continuing to assure that the local agencies will be able to respond to possible changes made by the State and Federal Government.

Best Management Practices

The Alameda County 208 Surface Runoff Management Plan emphasizes near-term, non-structural, source control measures (i.e., ordinances to modify or improve current practices, public information and education programs, maintenance of existing levels of street sweeping, inlet and drainage channel cleaning, and litter control practices).

Additional or improved service levels can be implemented when and if: (1) the problem is more precisely defined; (2) the need is more clearly demonstrated; and (3) some combination of financing from primarily non-local and some local sources can be arranged. These can then be implemented at relatively moderate cost in a short period of time to substantially reduce the quantities of surface runoff pollutants.

The controls proposed in this 208 plan are, in general, maintenance of existing "urban hygiene" services and then increased service levels if funding becomes available. However, existing service levels are in jeopardy of cutbacks due to budget pressures. Documentation of existing annual service levels indicates that street sweeping expenditures in Alameda County are over $2.3 million and inlet and drainage channel cleaning expenditures are over $2.4 million for a county of 1.1 million people. Indications suggest that there is a correlation between expenditure levels (measured on a per capita basis) and effectiveness of surface runoff controls. Annual local street cleaning costs are about $2.10 per capita. This compares very favorably with the national average of about $1.70 per capita. (Source: Pitt, et al, Systems Analysis of Street Cleaning Techniques, March 1976.) Total funds expended over the last few years to correct runoff related problems in County lakes and reservoirs exceeds $2.2 million.

Controls recommended in this plan for the agricultural community are minor. More investigation and work with the agricultural agencies is proposed in order to develop land management programs to mitigate the erosion problems on agricultural lands.

Pollutants and Sources

The Alameda County 208 effort has identified many problems associated with surface runoff within County interior waters. In general, the surface waters within Alameda County were found to contain varying amounts of pollutants. Specific pollutants in streams include: bacteria, sediments, heavy metals, organic matter and algal nutrients. Bacteria is the constituent of most concern because of the possible health hazards and shellfish contamination. Sediment is also a constituent causing concern because it impairs the proper operation of drainage and flood control facilities.

The sources of these pollutants are not known with certainty, but are believed to be: for bacteria-animal feces and sanitary sewage; for heavy metals (e.g., lead, zinc and copper) - vehicular traffic; for organic matter and algal nutrients - urban litter, including vegetation; and for sediment - erosion.

The mass emissions (i.e., quantities) of surface runoff pollutants are projected to increase at a small incremental rate in the future. This means that mitigation efforts should be both corrective and preventive in nature. Efforts to significantly reduce the mass emission rates for surface runoff pollutants must be directed toward existing conditions.

It is assumed that by significantly reducing the quantities of surface runoff contaminants to interior waters, that this will be a valuable reduction in surface runoff contaminants to San Francisco Bay. This reduction will be another step toward improving San Francisco Bay, yet not as costly as end-of-pipe treatment. The funds expended since 1940 to protect the Bay from pollution have been considerable and have had a demonstrable, positive impact.

The problem has been documented, defined and quantified as well as possible within the very limited time constraints. Extent of existing control efforts has also been investigated and documented.

Appointed Citizen Groups have met during the formulation of this draft plan. Further description of the Citizen Groups and their recommendations are found in Section V.

Financing

In some areas the benefits of non-polluted water are readily apparent (e.g., Lake Tahoe) but in other areas where the benefits may not be as precisely demonstrable (e.g., San Leandro Bay or San Francisco Bay) local decision makers may not feel sufficient public pressure to further commit the overly burdened property tax revenue. Federal support in these areas seems indicated in order to achieve the 1972 Congressionally mandated Goal of Clean Water.

Since local governments in the County are not fiscally capable of implementing improved service levels with existing revenues, funding sources other than local or additional local financing must be made available to implement the additional service levels of the 208 plan. Local governments do not lack the will, but do lack the financial capability to perform additional services. It has been suggested that Federal and State financing be made available for implementing additional service levels of the 208 plan in the manner similar to the 201 program (i.e., construction of sewage treatment plants with 87½% non-local funding). Should financing from State and Federal sources not materialize, and the need for additional local funding is clearly indicated to local elected officials, then considerable study would be required to determine the best source for such funding. The following describes one possible proposal for a financing mechanism to supply revenue for the proposed Alameda County SRMP, using ACFC&WCD as the funding vehicle for additional local funds.

One method of local financing is through the existing zone of benefit project funding arrangement that ACFC&WCD utilizes. One advantage of this approach is that political actions are necessary on simply a project-by-project basis. New zones would be needed for the four cities not currently included in a zone of benefit (i.e., Berkeley, Piedmont, Alameda and Albany).

Purpose of Plan

The philosophy of the SRMP can be summarized in five statements:

1. *The quality of County's interior waters (lakes and streams) should not be degraded further and, therefore, maintenance of existing service levels for water quality benefits (i.e., street sweeping, inlet and channel cleaning) is justified.*

2. *The problem severity does not justify implementing additional, i.e. improved, controls immediately.*

3. *A local management plan implemented on a phased schedule combined with a continuing planning and monitoring process can be established. The plan can respond to the wishes of local agencies as well as satisfy the State and Federal government.*

4. *Local field demonstration projects are necessary to determine the effectiveness and the appropriate levels of effort for recommended control measures.*

5. *The financial capability to achieve additional service levels does not currently exist at the local level.*

Goals, Objectives and Implementation Principles

The following represent the goals, objectives and implementation principles of the Surface Runoff Management Plan:

Goals

- o *To realize the maximum feasible maintenance and improvement in the quality of surface waters by utilizing management actions that are socially, politically, economically and environmentally balanced and acceptable to the people of Alameda County.*

- o *To develop cooperation among public agencies and to develop an awareness of the multiple benefits from related activities, and to utilize the opportunity provided by 208 to accomplish tasks heretofore thwarted by financial difficulties.*

Objectives

1. *To significantly reduce the quantity of the surface water pollutants entering Alameda County receiving waters.*

2. *To develop monitoring and testing programs to establish the effectiveness of the higher cost elements of the plan and to learn more about the nature of the problem.*

3. *To develop measures that can be easily revised if the effectiveness or public acceptability of a control measure is not supported.*

4. *To utilize existing public agencies to implement the plan and appoint a local management agency to administer, monitor and refine the plan.*

5. *To develop a phased implementation schedule beginning with:*

   a. *Actions that are ongoing programs (i.e., monitoring).*

   b. *Low cost controls, (e.g., education, new ordinances).*

   c. *Controls that are visually apparent to the public (e.g., litter control, oil recycling).*

   d. *Higher cost controls to be implemented after effectiveness is demonstrated by test programs and financing has been arranged.*

6. *To maintain current (1977/78) levels of environmental maintenance practices, (e.g., street sweeping, inlet and drainage channel cleaning).*

Because the SRMP is to be implemented, it is structured so that actions resulting from its implementation are accountable to the public. Citizens will be able to see recommended management actions, although they may not be able to directly judge whether or not pollutant loads on receiving waters are reduced. These actions may take the form of budget commitments, a workable waste oil recycling program or a street sweeping program with more frequent service. An addition to the public visibility of the program is monitoring of County's surface waters. Monitoring is important to evaluate effects of the actions and to assist in making changes in the plan.

It is recommended that the following implementation principles be incorporated into the Conservation Elements of the General Plans of cities and County:

Implementation Principles

1. *Public and private operation and maintenance practices should be conducted in accord with water quality objectives.*

    Current practices such as cleaning streets are primarily directed toward street aesthetics. Improvements directed toward water quality enhancement should be considered.

2. *Operation and maintenance budgets should be augmented as required to ensure that current (FY 1977-78) service levels be maintained for existing environmental enhancement practices.*

    In order for water quality to be maintained or not degraded further, current public works practices which enhance water quality objectives should not be diminished.

3. *New public and private construction projects should incorporate actions that enhance water quality.*

    Ground cover should not be unnecessarily disturbed during construction activities and replanting should occur as soon as possible. Erosion control practices should be developed to recover and hold the soil on the construction site.

4. *Technical support should be provided to local environmental education programs to compliment regional efforts.*

    Education is necessary to make the public aware of the County's water resources and the importance of maintaining and enhancing these resources.

5. *Ordinances and practices should be developed to promote and protect the integrity of County water resources.*

A watercourse pollution ordinance should be adopted and enforced to ensure that watercourses are kept litter free by providing the authority to prohibit the dumping or discharge of polluting material into the watercourse and to provide for setbacks from the watercourses to permit access to and along watercourse for maintenance and control of vegetation. More stringent grading and fill ordinances may be necessary to ensure adequate erosion control protection is practiced on new construction sites.

6. *Promote the use of cost effective non-structural solutions to reduce pollution.*

Water quality problems arise during each of the three stages of urbanization: rural land management, the land development process, and the maintenance of developed areas. Non-structural solutions should be initiated at the earliest point in these stages of urbanization.

7. *Establish reseeding and grading programs and practices which will provide adequate vegetative cover thereby mitigating water and wind erosion.*

Sediment deposits clog waterways, thereby reducing capacity to carry stormwaters as well as increasing the costs of maintenance operations. There has been excellent progress in technology to increase agricultural productivity and the potential for similar progress in watershed management for sedimentation control in rural and partially urbanized areas exists.

8. *Improve the maintenance of urban streets and parking facilities.*

Urban runoff contributes significant pollution to waterways with component dust, dirt and litter. Improved maintenance of roadways and parking facilities can reduce this problem at a relatively moderate cost, thereby improving the quality of waterways.

9. *Efforts should be encouraged towards learning more about water quality problems.*

Monitoring and research should be directed at establishing precise qualitative and quantitative problem identification.

Enforcement, Regulation and Implementation

Enforcement and regulation of the plan will be administered on two levels; on the local level and on the regional level. Because the County Surface Runoff Management Plan will be a part of the regional Surface Runoff Management Plan and the regional Environmental Management Plan (EMP) it must be administered on both of these levels. Implementation of the 208 plan is a local responsibility although State and Federal financial assistance may be necessary.

Federal/Regional - From the regional perspective there are three mechanisms for enforcement of the plan:

The Environmental Protection Agency (EPA) in accordance with Federal Register Volume 40 #235 of December 5, 1975, will require general permits for separate storm sewers discharges in urban areas under Section 404 of P.L. 92-500 i.e., the National Pollution Discharge Elimination System, (NPDES). It is assumed that the permit will require a discharger to be in compliance with the 208 Plan to obtain a discharge permit.

The A-95 Review Process is a procedure by which any federal grant to a local jurisdiction must be screened by a local clearing house - in this case ABAG. The grant must pass through this screening process in which review will indicate whether or not a proposed action is in conformance with the adopted 208 Plan.

It is anticipated the plan will become a part of the State's San Francisco Bay Basin Plan and as such will be administered by the Regional Water Quality Control Board (RWQCB). It is also anticipated the RWQCB will be the agency to administer EPA's, NPDES general permit program, wherein compliance with the 208 Plan will be required.

Local - From the local perspective, it is anticipated that cities and the County will be named as dischargers with the responsibility of complying with NPDES general permit program and 208 Plan. Implementation and administration would proceed along the following guidelines:

1. All surface runoff programs currently being administered at the local level of government would continue.

2. Clear implementation relationships would be defined between local, regional, state, and federal agencies for current and future plans.

3. Plan implementation will be carried out at the local level but will be monitored by the Regional Water Quality Control Board.

4. Annual reports will be prepared by local agencies and submitted to appropriate agencies.

As outlined in this plan, it is clear that many local agencies bear the responsibility for implementing the 208 Plan. For example, it is proposed that the ACFC&WCD, the Mosquito Abatement District and County Environmental Health Department would administer and enforce the requirements of the Watercourse Protection Ordinance. These agencies would coordinate the existing enforcement staff of inspectors to maintain surveillance over the area involved. These

inspectors would have to be given the authority to issue citations for violations of the ordinance (the ACFC&WCD would also be responsible for cleaning storm drain channels).

Local Public Works Departments would have the responsibility of enforcing the erosion control regulations, street cleaning programs and catch basin cleaning. Planning Departments would have responsibility in developing restrictive land uses in sensitive areas together with Building Inspection Department to control runoff from contaminated areas. Each jurisdiction's road department would be responsible for erosion resulting from road cuts.

Alameda County District Attorney would be assigned the task of actively prosecuting cases where misdemeanor violations occur as a result of ordinances adopted as a consequence of the SRMP.

County Sheriff and Municipal Police Departments would be assigned the added task of enforcing parking regulations, and anti-littering ordinances. The Solid Waste Management Joint Powers Agency would be required to develop anti-littering programs.

The Resource Conservation District (RCD) would be in charge of developing and administering controls regarding rangeland management which result in unacceptable erosion. The County Field Services Department with the RCD and County Planning Department would be responsible for activating the Animal Management Advisory Commission in the rural areas.

Cities and the County would be responsible for incorporating the implementation principles into the Conservation Elements of their General Plans.

Description of Multiple Benefits

Adoption of the SRMP as the future course of action to be taken by Alameda County will provide distinct, multiple benefits. These advantages are in the categories of 1) economic advantages, 2) recreation, 3) earlier results, 4) mosquito abatement, 5) reduction of flood hazards, and 6) a cleaner environment.

The major benefits in the economic advantage category are business development and improvement in the fisheries industry. Many businesses rely on water resource development projects. Boating and fishing are two examples. Another strong example is the marina development around Jack London Square in Oakland or the recreational activity on and around Lake Elizabeth in Fremont. As to the fisheries industry, the potential is large for improvement. To the extent that pollution is a factor, reducing the quantities of pollutants introduced into the water should help a comeback of the dungeness crab, oysters, clams and striped bass. In 1977 a well-funded attempt is being made to establish silver salmon in and around San Francisco Bay. It is possible that the fisheries industry may regain some of its prominence and achieve production levels of earlier years. Other benefits include: expended length of service of reservoirs; reduction in public cost of dredging flood control channels; mitigation of impairment of aquatic recreation activities from sedimentation; and potential for further appreciation of real estate values.

Recreation may present the highest potential for benefit. Eliminating the presence of debris, trash and litter in streams, watercourses, reservoirs and lakes has large aesthetic appeal. When control of bacteria is achieved, body contact recreation will be greatly benefited. Presently, bacteria is the constituent of most concern limiting swimming in the County. This coliform bacteria comes from the excrement of warm blooded animals and is an indicator of pathogenic (i.e., disease causing) bacteria which may be present.

Most of the recreation use which is impaired due to water quality occurs in existing parks. Alameda County has a generous supply of existing park space containing 12 lakes with water related uses (i.e., swimming, boating and fishing). Implementation of this plan will provide the framework to improve and maintain the integrity of these aquatic recreation areas.

This plan has been designed to improve future water quality and, as a consequence, the advantages inherent in clean water for future parks. Three large future aquatic recreation areas are currently being developed in Alameda County. The first is San Leandro Bay Regional Shoreline Park, which is to be a Regional Park in the dense, urban core area of North County. Next is the Hayward Shoreline Park which will preserve, in open space, the shoreline between San Leandro and Fremont. The South County shoreline (Fremont South) has become part of the 23,000 acre San Francisco Bay National Wildlife Refuge. The third park is a 450-acre quarry pit site acquired by EBRPD along Alameda Creek. All of these future parks will feature passive and active interaction with the water resource.

Management type controls, i.e., non-structural controls on runoff, will produce still other benefits. These are earlier results and lower cost. Non-structural controls are less costly than structural solutions on a watershed basis (e.g., Figure A shows structural control costs on the Castro Valley watershed). Also, management actions can be implemented sooner than a construction project because the actions required are already in practice and just need an increase in financing for additional frequency.

Also, the 208 planning process could bring about the amelioration of mosquito problems associated with the surface runoff of Alameda County. Improved management of the urban runoff systems would result in eliminating many existing sources and avoid new sources of breeding areas for the common household mosquito (*Culex pipiens*). Another advantage is that less insecticide would be used as a control.

An overall improvement of quality in the resource base of the environment will be the final benefit of the plan. Water is an integral part of our environment, and management of the degradation caused by stormwater runoff will result in aesthetic improvement, economic value, mosquito abatement, vector control and in total, a reduction in water-related health hazards.

Table 1 summarizes the BMP control measures recommended in the plan and the estimated cost above existing budget levels.

Figure A

Estimates of Structural Control Costs for a Treatment Facility at Castro Valley

	Abatement Level			
	Level 1	Level 2	Level 3	Level 4
Construction, Design, and O&M Total Present Worth ($)	4,600,000	37,600,000	38,900,000	65,700,000
Total Annual Cost ($/yr)	401,000	3,200,000	3,300,000	5,700,000
Required Land Area (acres)	1.0	9.6	9.7	10.0

Level 1 - Removal of Unaesthetic Debris (Bar screen, some removal of visual pollutants)
Level 2 - Removal of Sediment (Retention basin, 60-80% removal effectiveness)
Level 3 - Removal of Sediment, Bacteria and Associated Pollutants (Chlorination facility, "significant removal" effectiveness)
Level 4 - Removal of Sediment and Oxygen Demanding Loads (Aerated oxidation lagoon, respectively 90-75% removal effectiveness)

Note: Costs are in 1975 dollars and are based on a 6% amortization rate over a 20-year life. These costs are estimates. This facility does not exist.

Source: Water Pollution Abatement Technology: Urban Runoff, Capabilities and Costs; National Commission on Water Quality, NTIS, PB-247 391, December, 1975.

TABLE 1 -contd.

PLAN SUMMARY

Year 1 (July 1978 - June 1979)

Water Pollution Problem	Source	Control*2 Measure	Implementing Agency	Fiscal Source	Annual Cost/*1 Initial Cost in Thousands of Dollars
		Phase I - Initial Plan			
		A.1 Adopt SRMP Implementation Principles	Cities/Counties	Local	$0/$14
		B.1 Implement Public Education Programs	County/ABAG/ RCD	Local/ Regional	$73/$10
		B.3 Continue 208 TAC	Local Agencies	Local	*3
		B.4 Establish Plan Management Staff	ACFC&WCD	Local	$62/$0
Control Measure data deficiencies		B.5 Implement Castro Valley 208 Demonstration Project (Phase I)	ACFC&WCD	Local/ Federal	$0/$175
Water quality data deficiencies		B.6 Implement Monitoring Plan	ACFC&WCD	Local/ Federal	$61/$34
Presence of debris in creeks	Illegal human activity	C.1 Draft Watercourse Protection Ordinance	ACFC&WCD		*3
Presence of oil & grease	Illegal dumping	G.1 Implement Oil Recycling Program	Cities/County/ SWMJPA lead	State Funds	$73/$10

Conduct evaluation of program effectiveness and determine if next year's control measures are needed.

Total Phase I $269/$243

*1 Additional Cost - above existing budgeted programs.

*2 Control measure letter and number designations refer to those used in earlier draft reports.

*3 Costs for this activity to be assumed by Implementing Agency.

*4 Cost for this activity to be borne by Plan Management Agency (B-4).

TABLE 1 -contd.

PLAN SUMMARY

Year 1 (July 1978 - June 1979) contd.

Water Pollution Problem	Source	Control*2 Measure	Implementing Agency	Fiscal Source	Annual Cost/*1 Initial Cost in Thousands of Dollars
		Phase II - Continuing Planning Process			
		E.3 & E.4 Investigate Public Works Maint. Operation & Construction Practices	ACFC&WCD	Existing ongoing program E-2	*4
		M. Evaluate Agricultural Chemical Use Practices	County Agricultural Committee/RCD	Local	$0/$5
		N. Investigate Hazardous Material Spill Program	ACFC&WCD	Local	*4
		R. Investigate Non-Local Funding Sources	ACFC&WCD/RCD	Local/ Federal	*4
				Total Phase II	$0/$5

TABLE 1 -contd.

PLAN SUMMARY

Year 2 (July 1979 - June 1980)

Water Pollution Problem	Water Pollution Source	Control*2 Measure	Implementing Agency	Fiscal Source	Annual Cost/*1 Initial Cost in Thousands of Dollars
		Phase I - Initial Plan			
		A.2 Regulate Land Use in Sensitive Areas	City & County Planning Departments	Local	$0/$14
		B.5 Implement Castro Valley Demonstration (Phase II)	ACFC&WCD	Local/ Federal	
Debris in creeks	Illegal Dumping	C.1 Adopt and Enforce Watercourses Protection Ordinance	ACFC&WCD/MAD/ County Health Department	Local	$106/$0
Bacteria & Heavy Metal	Accumulation on Streets	D.1 Draft Street Sweeper Operator Training Program	ACFC&WCD	Local	$0/$15
		D.2 Implement Street Sweeper Operator Training Program and Adjust Schedules	Cities and County ACFC&WCD lead	Local	*3
Sediment	Erosion	E.2 Revise Grading & Fill Control Ordinances for Urban & Rural Areas	ACFC&WCD and RCD	Existing on-going program & Federal	$14/$16
		J.1 Activate Animal Management Adv. Comm.	County Field Services/RCD	Local	*3
Litter		S. Develop Anti-Litter Program	SWMJPA	State	$0/$5
				Total Phase I	$120/$50

Conduct evaluation of program effectiveness and determine if next years control measures are needed.

TABLE 1 -contd.

PLAN SUMMARY

Year 2 (July 1979 - June 1980) -contd.

Water Pollution Problem	Source	Control*2 Measure	Implementing Agency	Fiscal Source	Annual Cost/*1 Initial Cost in Thousands of Dollars
		Phase II - Continuing Planning Process			
Bacteria	Sewer line failures	O. Investigate Exfiltration problems	County Environmental Health	Local/ State/ Federal	To be investigated
		U. Investigate Neighborhood Composting Program	Cities/County/ SWMJPA lead	Local	*3
Sediment	Erosion	V. Develop Program of Agricultural Erosion Control	RCD	State/ Federal	$0/$20
		W. Investigate Use of Stormwater Detention Facilities	ACFC&WCD	Local	*4
				Total Phase II	$0/$20

TABLE 1 - contd.

PLAN SUMMARY

Year 3 (July 1980 - June 1981)

Water Pollution Problem	Source	Control*2 Measure	Implementing Agency	Fiscal Source	Annual Cost/*1 Initial Cost in Thousands of Dollars
		Phase I - Initial Plan			
Presence of oil & grease	Illegal Dumping	G.2 Enforce Prohibition on dumping or discharge into inlets	City & County Police Depts.	Local	$14/$14
		Y. Establish Animal Mgt. Standards	County	Local	$0/$5
				Total Phase I	$14/$19

Conduct evaluation for program effectiveness and determine if next year's control measures are needed.

Water Pollution Problem	Source	Control*2 Measure	Implementing Agency	Fiscal Source	Annual Cost/*1 Initial Cost in Thousands of Dollars
		Phase II - Continuing Planning Process			
Bacteria & Heavy Metal Contamination	Accumulation on streets	D.3 Investigate expansion of Parking Controls	Cities & Counties	Local/ State/ Federal	$14/$4000
		F.1 Investigate Detention and/or Treatment of Runoff	Cities & County	Local	$14/$14
		F.2 Divert Runoff away from Contaminated Areas	Cities & County	Local	$14/$14
		H. Investigate additional cleaning of Catchbasins and Inlets	ACFC&WCD	Local/ State/ Federal	$162/$720
				Total Phase II	$204/$4,748

TABLE 1 -contd.

PLAN SUMMARY

Year 4 (July 1981 - June 1982)

Water Pollution Problem	Source	Control*2 Measure	Implementing Agency	Fiscal Source	Annual Cost/*1 Initial Cost in Thousands
		No new controls initiated			

Year 5 (July 1982 - June 1983)

Phase II - Continuing Planning Process

		I. Investigate additional Storm Drainage Channel Cleaning	ACFC&WCD	Local/ State/ Federal	$775/$250
				Total Phase II	$775/$250

Year 6 (July 1983 - June 1984)

No new controls initiated

nduct evaluation of program effectiveness & determine if next year's control measures are needed.

Year 7 (July 1984 - June 1985)

Phase II - Continuing Planning Process

		D.4 Investigate Increasing Service of Street Cleaning	Cities & Counties	Local/ State/ Federal	$592/$680
				Total Phase II	$592/$680

ACCUMULATED TOTALS PHASE I 78/84 $403/$312

ACCUMULATED TOTALS PHASE II 78/84 $1,571/$5,703

II. EXISTING WATER QUALITY PROBLEMS

Four types of research and analysis were utilized to identify and document surface runoff related problems. Emphasis was placed on the interrelationships among these elements to assess the overall problem. These elements included (1) surveying agencies to distinguish the nature of the problem; (2) storm water monitoring and sediment analysis on three county watersheds to measure actual concentrations; (3) street surface contaminant loading tests to permit comparison with national data; and (4) computer modeling of the entire county using ABAG's "MAC" computer program to quantify surface runoff mass emissions (i.e., quantities).

Local Survey

The following responses were taken from a survey of agencies within the County to assist in identifying the nature of the problem.

1. Problems on Land

Septic tank malfunctions.

Significant cause of groundwater pollution. Minor sources of surface water problems. Problem users are in Oakland, Hayward, Livermore-Amador Valley, and suspected in Sunol.

--COUNTY HEALTH

Common household mosquitos may be produced in malfunctioning septic tanks.

--MOSQUITO ABATEMENT DISTRICT

Problem runoff from industrial storage yards or parking lots.

Industrial storage yards should be bermed. Problems are only detected when runoff is toxic and causes notable environmental damage. Parking lots are sources of grease and oil contaminants and in some instances it would be appropriate to utilize oil separators.

--COUNTY HEALTH

Erosion.

Significant in certain areas and of minor concern in most rural areas (especially "ranchettes" and range lands due to the drought). It is significant concern in areas that are converting from rural to urban. Examples are Cull Canyon and along many of our creeks and new developments in the hills and Fremont.

--SOIL CONSERVATION SERVICE

2. Problems in streams and other conveyance systems

Infiltration or inflow of stream runoff into sanitary sewers.

Mainly from faulty building sewer laterals from house to sewer main. Some inflow coming from illegal roof leader and yard drain connections. Reports indicate infiltration/inflow results in estimated 7 to 10-fold increase in quantity of flow over dry weather.

--OAKLAND

Cross connections between storm drains and sanitary sewers.

In some areas of backyard sewers, property owners have illegally connected roof leaders, ground drainage, and fish ponds to sanitary sewers. City requires disconnection when found.

--SAN LEANDRO

Overflow of sanitary sewers onto streets.

Overflows caused by temporary blockage in sewer system or closure of interceptor or interceptor diversion structures. Overflow possibly may also occur during extreme wet weather flow periods.

--OAKLAND

Siltation and dirt accumulation in storm sewers and channels.

Dirt is washed off streets during rainstorms and settles in storm drains and catchbasins. City has annual program of cleaning catchbasins.

--SAN LEANDRO

Grease, oil, debris, or lawn clippings floating in channels and/or sloughs.

Most cities have regulations prohibiting the disposal of such materials, but none enforce these requirements. Also needed are community oil and rubbish disposal areas.

--COUNTY HEALTH

3. Problems in Receiving Waters

Impairment of fishing due to water quality degradation.

High bacterial concentrations in surface waters impairs quality of fishing. Aquatic life is significantly affected by siltation.

--COUNTY HEALTH

Fish kills.

Fish kills reported in Lake Merritt and a few local areas. Lake Merritt kills are due to low dissolved oxygen. Other kills are due to surface discharge of toxic materials.

--COUNTY HEALTH

Impairment of recreation activities (swimming and boating) due to storm runoff.

A perfect example is Cull Canyon Reservoir. This problem is common in all watersheds of the County. Sedimentation and erosion remove good soil from production areas and are deposited in areas of recreation.

--SOIL CONSERVATION SERVICE & RCD

Lake Merritt and Lake Temescal are affected by surface runoff. Lake Merritt was posted; Lake Temescal may be closed if conditions don't improve.

--COUNTY HEALTH

Bacteria levels in surface water.

We have considerable data available for Lake Merritt watershed and certain other areas throughout the County.

--COUNTY HEALTH

Stormwater Monitoring

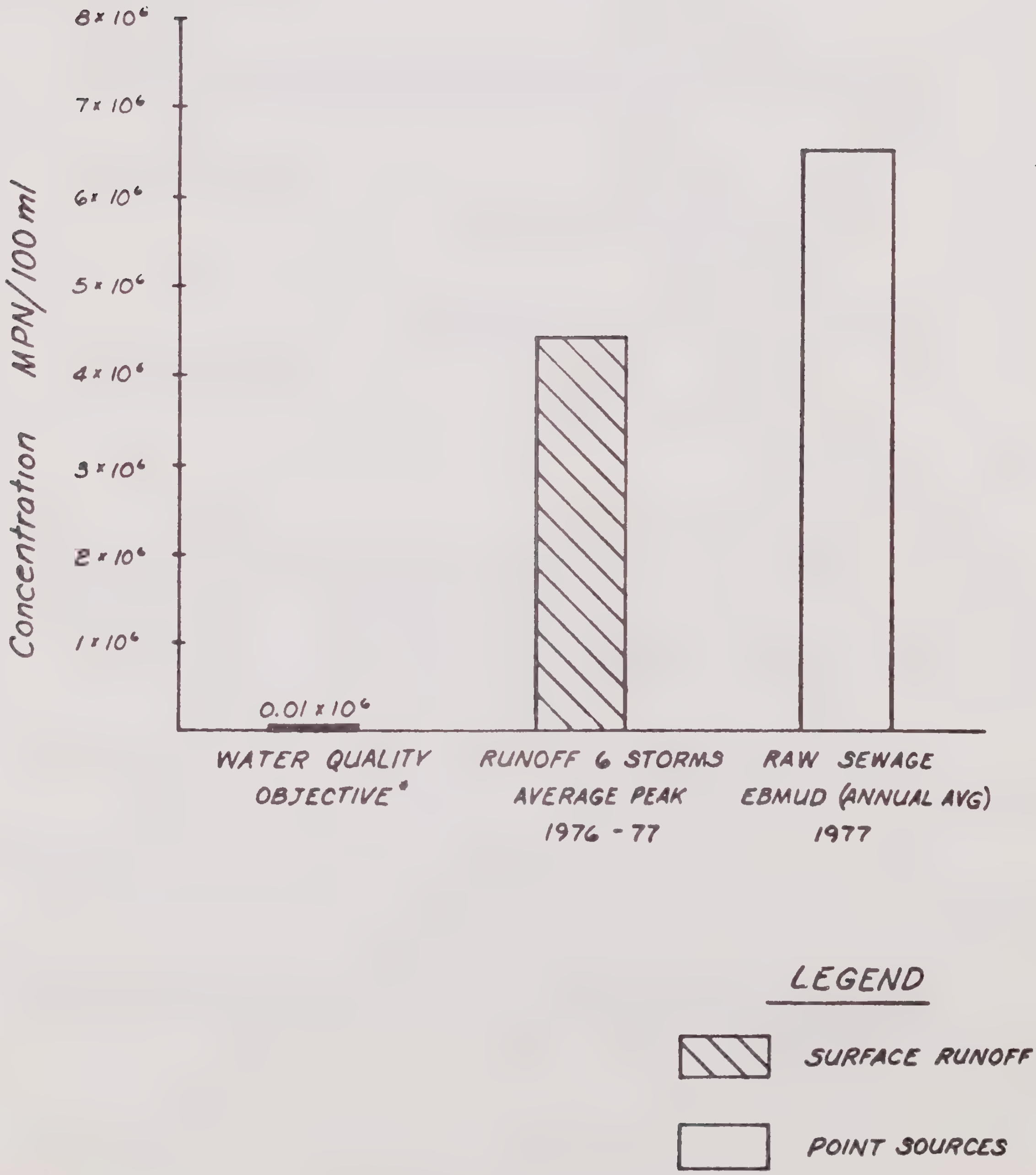
- Measured concentrations of bacteria in surface runoff in streams (storm and non-storm) greatly exceed established standards for body contact recreation (i.e., swimming) (See Table 2). Bacteria concentrations in storm runoff are believed by the Regional Water Quality Control Board (RWQCB) to be responsible for the bacteria concentrations in shellfish along the San Francisco Bay shoreline in Alameda County.

- Measured concentrations of algal nutrients (nitrogen and phosphorus) are considerable and contribute to the production of algae and other noxious, excessive aquatic weed growth in interior waters.

- Measured concentrations of oxygen (as represented by biochemical oxygen demand [BOD]) in urban runoff about equals that of secondary treatment effluent.

- Measured concentrations of heavy metals, particularly lead and zinc, greatly exceed maximum acceptable concentrations in relation to the 96 hour, LC_{50} test in which concentrations kill 50% of the test species within 96 hours under standard bioassay conditions.

SURFACE RUNOFF COMPARED TO POINT SOURCE CONCENTRATIONS ON GLEN ECHO CREEK-OAKLAND FOR COLIFORM BACTERIA



* From S.F. Basin Plan

• Measured concentrations of sediment indicate the presence of erosion. An estimated erosion rate (associated with construction sites) using the Universal soil loss equation and appropriate factors for Alameda County is about 10 tons/acre/year. Natural rates of erosion should be made known for all soil series within this planned area, and provision made to identify accelerated erosion rates, prior to implementation of Best Management Practices.

Street Surface Tests

• Local accumulation rates are much lower than comparable U.S. data except for some Alameda County lead and zinc values that are as much as twice as high. This data was gathered as a product of a continuing plan to collect data to be used to quantify pollutant loadings (See Support Document).

Modeling

• In general, existing and future surface runoff (non-point) loads contribute significant quantities of water pollutants compared to municipal sewage treatment plants (See Table 3).

• The predominant quantities of storm runoff pollution entering San Francisco Bay originate from the urban areas. In other words, along Alameda County's "Bay Plain" urban runoff is the concern.

• Sediment quantities are considerable and generated predominantly from the rural, east county areas.

• Bacteria from both storm and non-storm runoff is the major constraint on local waters with beneficial uses.

• Nutrients are generated predominantly from treatment plants.

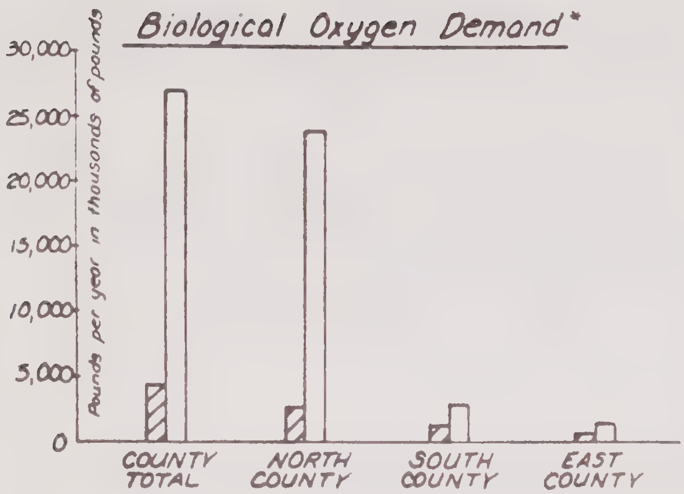
• Runoff contributes approximately 40% of the total oxygen demand released (from Alameda County) to San Francisco Bay during the wet season and are implemented for point sources, particularly EBMUD. Heavy metals, particularly lead, zinc, copper and manganese, which are released into our receiving waters, result overwhelmingly from non-point source.

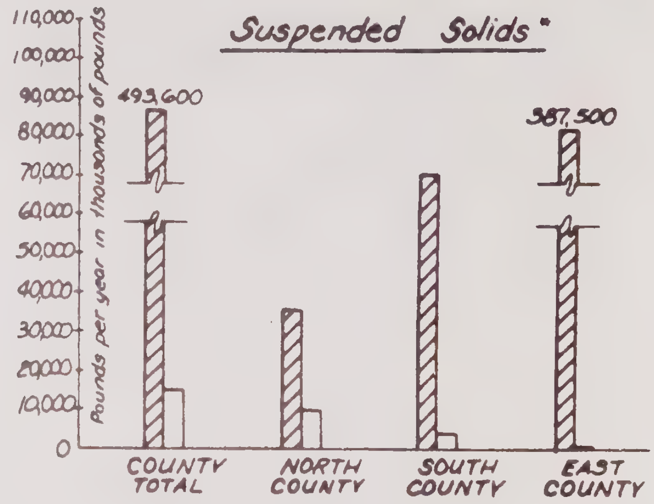
• The quantities of surface runoff pollution appear to reach a steady-state condition during the 1975 to 2000 investigation period. Existing and projected pollution to San Francisco Bay is caused by the existing developed conditions and not by future development to any significant degree (except sediment generated by future construction and rural land practices).

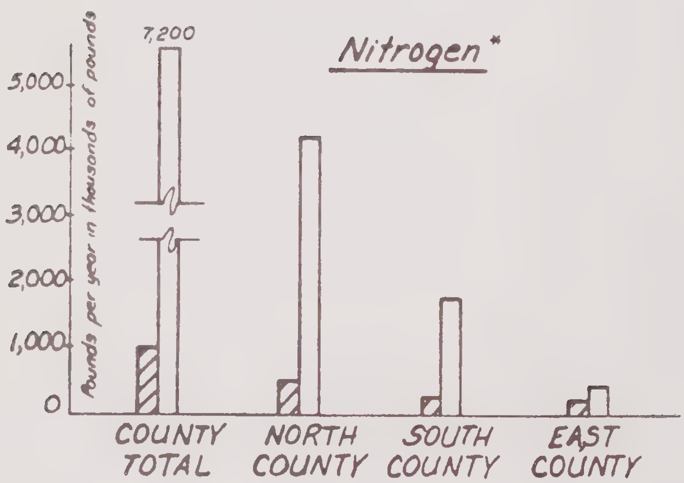
Discussion of Alameda County Selected Water Bodies

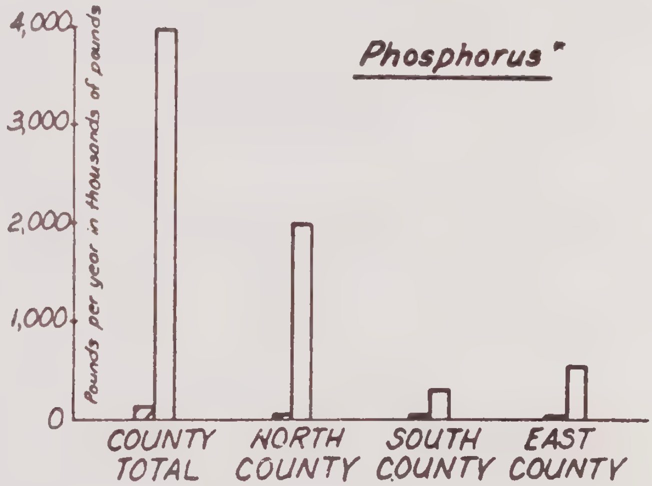
Surface water quality investigations conducted by the County since 1972 and the recent investigations of urban stormwater runoff have verified the existence of substantial and widespread pollution of local interior waters. Bacteria and sediment are the pollution constituents of most concern degrading our waters. Table 4 constitutes a detailed problem identification of the impacts on selected local receiving waters. The following is intended to serve as a selective discussion of three specific County receiving waters:

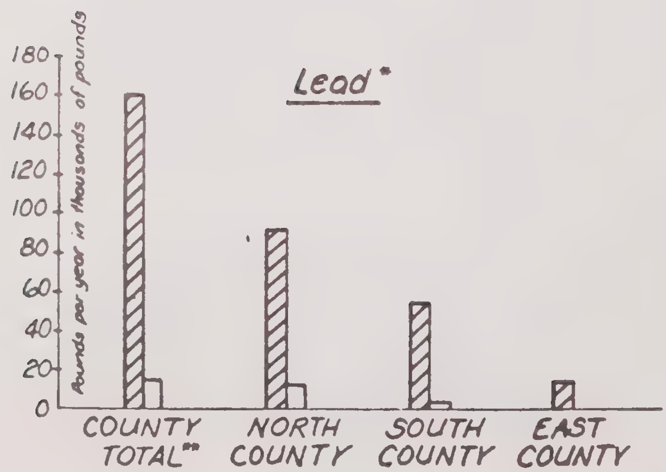
SURFACE RUNOFF POLLUTANT LOADS COMPARED TO POINT SOURCE LOADS











LEGEND

Surface Runoff
Point Sources

* Based on MAC results using 40 yr. avg. rainfall 1975 ABAG Series 3 Land Use, ABAG Treatment Plant Projections & Local runoff coefficients.

** County total for point source lead pollutant excludes East County.

Table 3

TABLE 4 BENEFICIAL USE CONSTRAINTS ON SELECTED LOCAL WATERS

	NO.	SURFACE WATERS	TRIBUTARY LAND USE	BENEFICIAL USES						SUSPECTED CONSTRAINTS						
				Recreation		Habitat		Water Supply		Surface Runoff				Sediment Erosion		Sewage
				Body Contact	Noncontact	Aquatic	Wildlife	Municipal	Ground-water	Nutrients	Bacteria	Oxygen Demand	Heavy Metals	Urban	Rural	
NORTH COUNTY		CREEKS														
	1	Cerrito														
	2	Codornices														
	3	Harwood			X	X	X									
	4	Strawberry				X	X									
	5	Arroyo Viejo			X	X	X									
	6	Courtland				X	X				X					
	7	Glen Echo				X	X				X					
	8	Trestle Glen				X	X				X					
	9	Lion			X	X	X									
	10	Peralta			X	X	X									
	11	Sausal			X	X	X									
	12	Seminary														
	13	Temescal			X	X	X							X		
	14	Elmhurst				X	X							X		
	15	San Leandro	O,R,C,I		X	X	X				X		X			
		LAKES														
	16	Lake Merritt	R,C		X	X	X			X	X	X		X		
	17	Lake Temescal	R		X	X	X				X			X		
	13	Aquatic Park	R,C,I		X											
	19	The Lagoon (Ala)	R		X											
	20	Upper San Leandro Res.	O,R			X	X	X								
	21	Lake Chabot Res.														
		BAYS														
	22	Alameda Estuary	R,C,I		X											
	23	San Leandro Bay	R,C,I			X	X				X		X	X		
	24	San Francisco Bay			X	X	X									
SOUTH COUNTY		CREEKS														
	25	Castro Valley			X	X	X									
	26	Chabot			X	X	X									
	27	Crow Canyon			X	X	X									
	28	Cull			X	X	X								X	
	29	Morris			X	X	X									
	30	Palomares					X									
	31	Alameda M.O.C.				X	X				X	X	X		X	X
	32	San Lorenzo	O		X	X	X									
	33	Sulphur			X	X	X									
	34	Bockman Canal									X			X		
	35	Alameda	O		X	X	X		X	X				X		X
	36	Crandall			X	X	X									
	37	Dry			X	X	X									
	33	Mt. Eden				X	X									
	39	Mowry Slough				X	X									
	40	Newark Slough				X	X									
	41	Plummer														
	42	Torogas														
	43	Ward			X	X	X									
	44	Zeile			X	X	X									
	45	Aqua Caliente			X	X	X									
	46	Aqua Fria			X	X	X									
	47	Canada del Aliso														
	48	Mission			X	X	X									
	49	Mud Slough				X	X									
	50	Scott			X	X	X									
		LAKES														
	51	Lake Elizabeth	R,O		X	X	X									
	52	Cull Canyon	O		X	X	X								X	
			O		X	X	X	X		X						
	53	Don Castro	O		X	X	X									
	54	The Lake (Newark)	R		X											
		BAYS														
	55	San Francisco			X	X										
EAST COUNTY		CREEKS														
	56	Alamo					X									X
	57	Altamont					X									
	58	Arroyo de Laguna					X		X							X
	59	Arroyo las Positas					X									X
	60	Arroyo Mocho			X		X		X							X
	61	Arroyo Seco					X									
	62	Arroyo Del Valle			X	X	X		X							
	63	Cayetano					X									
	64	Collier Canyon					X									
	65	Corral Hollow					X									
	66	Cottonwood					X									
	67	Dublin					X									
	68	Eden					X									
	69	Hollis Canyon					X									
	70	Martin Canyon					X									
	71	Sinbad					X									
	72	Tassajara					X									
	73	Laurel					X									
	74	Gold					X									
	75	Tehen Canyon					X									
		LAKES														
	76	Del Valle		X	X	X	X	X	X							
	77	San Antonio Res.														
	78	Calaveras Res.						X								
	79	*Shadow Clifts*	O	Y	X	X			X							

*Basin Plan concept

C - Com.
I - Ind.

R - Res.
O - Open Space

Table 4

Lake Merritt in downtown Oakland (population 350,000) has a watershed of about 7 square miles (4510 acres). Land use in this watershed is 54% residential, 13% commercial, and 33% open space. Boating, aesthetic enjoyment and nature education are the major recreational activities of the lake. Also, it is an aquatic and wildlife habitat, and is aesthetically enjoyed and utilized by many residents of the City and of the Region. The major constraints degrading beneficial uses are nutrients and bacteria. The sources of this contamination are domestic sewage, urban runoff, waterfowl (including extraneous feeding), and inflow from the Alameda estuary and channel. Actions are being taken to remedy the in-lake conditions, however, urban hygiene or housecleaning of the watershed is a continuing necessity. In 1977, a contract was awarded by the City to develop a comprehensive lake management program. Specific items considered by the study are: (1) to measure the flushing rate and the hydraulic dynamics of the circulation system; (2) to measure bacteria survival rates; (3) to evaluate alacides for control of noxious alage; and (4) to recommend changes in lake maintenance operations. By March, 1978, the sources will be quantified, prioritized, and recommendations for improved management submitted.

When best management practices are recommended and non-local financing is arranged, the increased level of urban hygiene services will greatly improve the quality of Lake Merritt waters.

Lake Temescal Regional Park is only three miles from Oakland's City Center and has a watershed of about three square miles (1,900 acres) containing two square miles of single-family residential land use and one square mile of highway and tunnel disturbance area. Because of its location, this freshwater lake is one of the most intensively used recreation lakes in the San Francisco Bay Region. Visitor days total more than 750,000 each year and both swimming and fishing are popular activities. The major water quality constraint degrading its beneficial uses is sediment. Erosion was substantially accelerated by residential construction near the lake and by highway construction. Much of the sediment produced found its way into the lake. In just one decade, from 1963 to 1973, the lake's volume was reduced 39% as a result of sedimentation. In 1977, the East Bay Regional Park District (EBRPD) was awarded a $440,000 grant from EPA's "Clean Lakes Program" for lake restoration (i.e., desilting). The project narrative's problem definition includes oxygen depletion, high bacteria concentration and high bacteria levels. This has resulted in accelerated "eutrophication" and potential closure of the lake from swimming and other body contact recreation. Eutrophication results from a deleterious rate of sediment and nutrient yield from the watershed in the lake. It is the lake's life cycle process and is analogous to the end of life for the lake.

It is anticipated that future increased levels of "urban hygiene", or best management practices of streets, inlets, septic tanks, and drainage ways along with the current structural restoration program will greatly extend the life of the lake.

Alameda Creek and its tributaries drain a primarily rural basin of 633 square miles that cover the East County and portions of Santa Clara and Contra Costa Counties. The study area contains three urban population centers (Dublin, Livermore, Pleasanton) totaling approximately 110,000 persons. The creek serves as a conveyance for stormwaters as well as treated sanitary sewage effluent. The creek is also used for groundwater recharge allowing percolation of surface waters into the groundwater basins. There are two impacted groundwater basins.

One underlies the Fremont area (Niles cone) and supplies residential and commercial needs of the South County areas (Fremont, Newark, and Union City). The other basin underlies the Livermore Valley which serves residential and agricultural needs of the Valley. Both groundwater systems are affected by surface runoff. Concern for groundwater management is a part of the present five year, $1.2 million, water resource Urban Study (e.g., flood control and water quality) by the Army Corps of Engineers. Recent legal actions are underway between certain local jurisdictions regarding discharges to Alameda Creek which further emphasizes the importance of this water resource. Because of the potable water use and conclusion drawn by ABAG's study that future surface runoff samples of Alameda Creek be analyzed for the presence of any identifiable carcinogens or other organic compounds having cancer-related synergistic effects.

Problem Severity and Ranking

o The presence of grease, oil, debris and lawn clippings floating in channels and sloughs is a county-wide aesthetic, visual problem. Local regulations exist. However, enforcement of regulations prohibiting the disposal of such material is necessary to control this very publicly visual problem. This problem is ranked as primary because of its visibility. Potential solutions are best directed at moderate to long-range attitude changes in potential offenders. Experience has demonstrated the difficulty of enforcement.

o Bacteria is the constituent of most concern in interior waters because of the potential health hazards. In San Francisco Bay bacteria is the constraint prohibiting commercial harvesting of shellfish. The extent to which this problem negatively impacts the shellfishing industry is not known. The negative economic impact is assumed to be severe since the industry is not permitted to harvest and thus utilize this potentially large economic resource.

o Erosion, the principal source of sediment, accounts for the loss of hundreds of thousands of cubic yards of soil from Alameda County which could be "saved".

o Groundwater basins which augment drinking water supplies of over 250,000 persons in South County are "recharged" and thus impacted by Alameda Creek. In 1977 legal actions were taken involving certain jurisdictions regarding point source discharges to Alameda Creek. Alameda Creek receives sanitary sewage effluent, agricultural runoff (with a potential for pesticides) and urban runoff. ABAG's "Toxic Substances Special Study" reached a significant conclusion which may be directly relevant to Alameda Creek because of its potable beneficial use. ABAG's scientists concluded that carcinogens are present in the food chain of San Francisco Bay. The presence of potential carcinogens in Alameda Creek and the groundwater basins might be documented by a monitoring program. This study of potential carcinogens in Alameda Creek water should consider the near-future change of conditions regarding the LAVWMA discharge to San Francisco Bay. The feasibility and costs of tests for carcinogenic compounds will be discussed with USGS and possibly included in the on-going joint monitoring program with the Alameda County Water District.

o Heavy metals concentrating in Alameda County waters are over the national average.

Many of the beneficial uses of receiving waters (which state and local regulatory policies have sought to protect) are known to be vulnerable to even relatively small amounts of these toxic heavy metals.

There are three reasons why there is concern about controlling discharge of toxic materials: (1) the specific chemical forms of the discharged contaminants are not known; (2) there is considerable uncertainty regarding the receiving waters' tolerance for such materials. It is known, however, that these metals tend to be concentrated as they pass through successive links of the food chain (concentrating by factors of thousands to one); (3) some of the relatively harmless chemical forms are subject to change into harmful forms, e.g. inorganic mercury compounds to methylmercury.

This last point suggests the possibility that toxic substances could be discharged to receiving waters for some time with an observable effect. Conditions could eventually change such that adverse conditions may develop.

Problems Solved by the Plan

In general, recommended controls are maintenance of existing programs and if financing becomes available, expansions of existing service levels. The following serves as a general description of how the control measures proposed by the plan will attempt to mitigate problems:

1. Presence of debris and litter in creeks, and oil on the water's surface.

Direct management actions are recommended for this problem. Local and regional education efforts will seek to raise the public level of awareness as to the unacceptability of littering. Informational messages developed and paid for by ABAG and carried by the media will serve as the vehicle for this continual attempt at consciousness raising. Increased cleaning maintenance of inlets, catchbasins and watercourses is proposed. Enforcement of existing and proposed ordinances, however, is fundamental.

2. Contamination by heavy metals.

Again, direct actions are recommended for this problem. Continued level of service in street sweeping, combined with expanded parking restrictions can further reduce the quantities of heavy metals available to contaminate the receiving waters. However, adequate financing must be made available to fund any additional service (e.g., expanded parking restrictions).

3. Growth of unsightly and noxious algae and aquatic weeds.

Street sweeping is also effective at removing the algal nutrients' accumulation from dirty streets. Also, the erosion controls will reduce the amounts of sediment with attached nutrients available for accumulation in the channels and on the streets.

4. Contamination from bacteria.

This is the problem of most concern, and the most difficult to control. However, the substance of actions (e.g., improved street sweeping and exfiltration studies) should not be misleading. The key to solving this problem is when the suggested controls are implemented. The longer implementation of the controls is delayed, the greater the cost in lost opportunity and economic loss in terms of body contact (i.e. swimming) recreation and economic return from fisheries.

5. Erosion of streambanks, topsoil and land surface.

Erosion is a natural process but man excerbates the situation with his activity (e.g., construction and agriculture). The controls directed at this problem will mitigate the "problem aspects" caused by man, but they can never and should not attempt to eliminate the natural erosion process itself.

III. RECOMMENDED CONTROL MEASURES SUMMARY DESCRIPTION

Further explanation of these control measures and management actions is discussed in the Support Document. The plan is divided into two Phases, the "Initial Plan" and the "Continuing Planning Process."

Initial Plan

The purpose of the initial plan is to set in motion the beginnings of the 208 surface runoff management effort. This is achieved by establishing responsibility for surface runoff management planning within an existing agency (i.e., Alameda County Flood Control and Water Conservation District) and identifying agencies with implementation action responsibilities. A secondary purpose is to set in motion a process which may lead to implementation projects that have demonstrated appeal, multiple benefits and applicability. The plan is to be flexible so that controls can be added or deleted as the plan evolves from the continuing planning process.

Continuing Planning Process

The primary purpose of the Continuing Planning Process (C.P.P.) is to investigate primarily management practices that may or may not lead to future implementation projects. Cost estimates shown on Table 1 are primarily administrative in nature and will change if the C.P.P. measures move into a Phase I initial plan implementation mode. The C.P.P. is the classic planning iterative (feedback) component within the plan from which knowledge gained from preceding elements is used to further refine the plan. The proposed Castro Valley 208 Demonstration Project is an example of a test project designed to supply objective measurable data necessary for future decision making,program evaluation, and plan evolution.

At those times indicated in Table 1 an evaluation to assess the controls to be initiated should be made. The purpose would be to determine if the next year's control should be continued or implemented. This procedure would involve analysis of nonstorm and stormwater monitoring data, street surface tests and computer modeling. The Plan Management Staff would be responsible for conducting the evaluation and update of the plan and annual report of plan implementation.

The realization of the pollutant characteristics of surface runoff has been developing for some time. The drafters of P.L. 92-500 recognized this when they prepared Section 208 to emphasize management planning to control drainage-related pollution. The intent of Alameda County's Surface Runoff Management Plan is to organize the collective efforts to reach a balanced solution to the pollution problem. This has not been done before. A management approach to control drainage quality (i.e., surface runoff) should start from a comprehensive perspective.

The first task in a comprehensive water quality management approach is to establish the responsibility for management and planning within a single agency. As proposed under Control Measure B-4, Establish Plan Management Staff,

ACFC&WCD would be directed to assume the water quality responsibility for the Alameda County Surface Runoff Management Plan (certifying conformance to the plan and the updating of the plan through the C.P.P.). The District currently possesses most of the necessary expertise to perform this task, and has the legal authority and financing mechanism. The District is already the major storm water discharge authority for the County operating most of the major outfall channels and many of the other minor creeks and drainage trunk lines.

It is assumed that the process of continuing planning for water quality enhancement will be initiated once the County plans are integrated into the regional EMP, with ABAG and County continuing to act in roles similar to that established for developing the initial planning effort. It is through the continued cooperative effort that the County Plan Management staff will be expected to work.

The following is a brief description of the recommended control measures:

A. General Policies

1. Adopt Surface Runoff Management Implementation Principles. When these principles are implemented, operational practices will beneficially influence water quality. The SRMP principles are to be incorporated into the Conservation Element of City and County General Plans by actions of the respective governing bodies

2. Regulate Land Use in Sensitive Areas. The purpose of this action is to prevent uses with a high risk of releasing pollutants into water bodies (e.g., sanitary land fill, chemical manufacturing) from locating near water bodies without adequate mitigation efforts.

B. General Administration

1. Implementation of Public Information and Education Programs is necessary for the public to become aware of and to understand specific environmental problems and solutions. Widespread community support is vital to assure effectiveness of all environmental protection efforts. It is intended that all agencies will utilize the program looking to one coordinating agency to take responsible lead (i.e., County Planning Department) and to supplement programs of other agencies. It is anticipated that added staff will be required and the cost for this action reflects this. In addition to permanent staff, this measure includes cost for publishing information on control items like the oil recycling and disposal program, workshops, and one time cost for consultant services. Citizens at the public participation meetings felt that public education to produce a more environmentally conscious individual was the best solution. One local School District has already embarked on a "hands-on" learning process in the high schools by having students actually measure water quality at the regional shoreline park. This is a representative example of the multi-purpose benefits that are looked for in control measures. ACFC&WCD staff is expected to lend technical support to these educational efforts. However, ABAG or some regional agencies are expected to take the lead in the regional effort.

B - 3. Continuation of the 208 Technical Advisory Committee (TAC) will provide input to the continuing planning process from all jurisdictions in the County who want to participate and will assist in maintaining an overall review function of the plan in evaluating the effectiveness of actions being carried out.

B - 4. Establishment of a Plan Management Staff will assure that the planning and monitoring functions necessary to annually update the plan will be located in an existing agency which is operational. Staff will co-ordinate the TAC, monitoring, Castro Valley 208 Demonstration project and follow through on the Continuing Planning Process. Specifically, this management staff will be responsible for assistance in drafting the Watercourse Protection Ordinance (C-1), revising the construction control ordinance (E-2), investigating the hazardous material spill program (N), and investigating non-local funding sources (R). Further duties would include assistance in drafting the operator training program (D-1), investigating public works erosion control practices (E3 & 4), assistance in implementing the operator training program (D-2), investigating neighborhood composting program (U), and assistance in investigating the use of stormwater detention facilities (W). This measure requires additional staff persons with ACFC&WCD acting as lead.

B - 5. Implementation of the Castro Valley 208 Demonstration Project will provide objective, "real-world" effectiveness values for recommended control measure categories. The experiment involves monitoring of water quality in Castro Valley Creek, while control measures are phased in. The first phase involves no additional controls (base line conditions). The second phase will implement the watercourse protection ordinance (C-1 & 2), strict enforcement of anti-littering ordinances, oil recycling or disposal program (G-1), and cleaning of inlets and channel (H & I). The third phase would involve improving street sweeping (D-1 thru 4) and requiring erosion control measures on construction in the watershed (E-2 & 4). The results can then provide direction to future courses of action in selecting performance levels of measures to mitigate surface runoff pollution. Cost of the demonstration project is assessed as an initial cost item even though it is spread over a three-year period. The major item of cost in this experiment is for consultant services. This control measure is further explained on Page III-

B-6 Implementation of the Monitoring Plan (fully described in the Support Document) will provide necessary documentation of problems and establish base-line water quality conditions. Surface Water Monitoring is a key activity in the Castro Valley 208 Demonstration Project (B-5). This program proposes monitoring surface waters both on a storm runoff basis and on a non-storm basis as well as on a developed and undeveloped watershed. ACFC&WCD has been committed to a water quality data collection effort since 1972. As a result of the 208 Program the District has reoriented its data collection efforts to include acquisition of water quality data during storm runoff events. One of many

visible, accountable actions resulting from the 208 Program is the commitment of staff and resources from Flood Control District towards water quality data collection. A monitoring plan has been designed to accomplish three major objectives: (1) to assess the effectiveness of alternative water quality control measures proposed for stormwater pollution; (2) to determine the ambient water quality of the County's inland receiving waters; and (3) to qualify and quantify the pollutants generated by storm runoff from selected watersheds that ultimately impact the major receiving waters of the County and San Francisco Bay. A copy of the monitoring plan is included in the Support Document. It is proposed that the ACFC&WCD be directed to implement the monitoring program because this is an existing program of this agency.

C. Control Littering

1. Adoption of a Watercourse Protection Ordinance is necessary to provide authority to prohibit the dumping or discharge of litter, trash, debris, toxic chemical substance, sanitary sewage or any other material into a watercourse. It should also provide for setbacks within or from the creek to permit access to and along the watercourse for maintenance and control the removal of vegetation along the creek banks to reduce erosion. The ordinance would be drafted by ACFC&WCD in cooperation with all jurisdictions and is proposed to be adopted by all Cities and County. The ordinance would consolidate existing multi-agency efforts into one stream enforcement authority.

   Enforcement is vital for this ordinance to be effective. "Creek Inspectors" must have authority to issue citations for violations. County Environmental Health Department has this citation authority. Other agencies may seek this authority also if the need is demonstrated. The lead for this measure is shared with County Environmental Health Department, ACFC&WCD and Mosquito Abatement District with assistance and cooperation from State Fish and Game and City Public Works Departments. This measure requires additional "Creek Inspectors."

D. Improve Street Sweeping

1. Improve Street Sweeper Operator Training Program could significantly increase effectiveness of the street sweeping operations. It should focus the operator's attention on dust-and-dirt-size materials, make them more aware that fine materials tend to accumulate in areas nearest the gutter and emphasize the need to operate equipment within optimum speed ranges of 3 to 5 mph and to position the broom carefuly. Present operating speeds average from 6 to 8 mph. The care with which street sweepers are utilized is probably more important a factor than even the type of sweeper. The County Public Works Agency would act as the lead agency to coordinate the program with all Public Works Departments. Consultant assistance has been provided for in the cost analysis for this measure.

D- 2. Implementation of Street Sweeper Operator Training Program is necessary and each municipal jurisdiction is expected to provide time for this instruction as part of the existing annual training program. Little or no additional cost is anticipated since most jurisdictions have training programs. The County Public Works Agency would take lead in training.

3. Investigate Expansion of Parking Controls. Additional parking controls could significantly increase the effectiveness of street sweeping operations. A rearrangement of schedules to provide night street cleaning in commercial and industrial areas coupled with no parking during cleaning hours and daytime street cleaning with alternate side of street parking restrictions in residential areas could increase the percentage removal of street surface contaminants to about 50 percent. All parking control programs must be carefully designed to minimize the burden on car owners so that the program can be politically feasible. Expanded parking control probably will not be feasible in those locations where parking is extremely limited. Data collected locally indicates that in Alameda County a street cleaning program with parking control is cost-effective (50 to 300 percent more effective than existing operations, depending on the land use). It is expected that doubling of current removal rates can be achieved with a moderate cost increase. The City of Oakland has experienced that the non-compliance rate in the parking control program may not generate enough revenue from parking tickets to offset the cost of enforcement. Implementation of this best management practice is contingent upon a more precise demonstration of feasibility and availability of non-local funding. Feasibility and details of this control measure to be developed during the Continuing Planning Process, Phase II of the plan.

4. Investigate Increasing Service of Street Sweeping. In residential and industrial areas additional service could remove a significant portion of the contaminants which accumulate on paved surfaces. These surfaces are estimated by the principal researchers in the field of urban runoff control to contribute a significant portion of contaminants available to surface runoff. Complete implementation of this control measure (if necessary) by the cities and County is suggested after 1985 so as to allow performance standards from pilot testing programs and the securing of funds to be established. Jurisdictions (especially those with major recreational use water bodies) are encouraged to increase sweeping frequencies to once per week in first industrial then residential areas before the 1985 date. This appraoch should cause a quicker realization of benefits resulting from a reduction in pollutant loadings to receiving waters. This measure entails substantial startup and continuing costs to most jurisdictions. Federal funds will be solicited for the capital costs of new equipment. It is noted that street sweeping probably cannot be effectively applied to unimproved streets, i.e., those without curbs and gutters.

E. Control Erosion

1. Watercourse Protection Ordinance (see C-1). This ordinance will regulate construction-caused erosion in or adjacent to watercourses and also regulate removal of vegetation in or adjacent to watercourses.

2. Revise Grading and Fill Control Ordinances for Urban and Rural Areas. With adequate enforcement this measure could substantially reduce the erosion from disturbed soils that cause turbidity and sedimentation in the water bodies and loss of valuable top soil. Enforcement would be accomplished by issuing a permit for disturbing the surface soils over a minimum area or volume or type of activity (to be determined).

   In the urban area, revised ordinances or policies may be necessary to require an acceptable erosion and sediment control plan by developers as a precondition to receiving a building permit.

   In the rural area (i.e., agriculturally zoned) ordinances would be necessary to require a grading and fill permit. An erosion and sediment control plan in the rural areas would be required by the permit to be approved by the appropriate Building Official and/or Resource Conservation District (RCD) for agricultural areas. Inspection of agricultural operations would be accomplished by RCD which would report non-compliance to the appropriate Building Official. Inspection and enforcement in urban areas would remain with the appropriate local Building Official. Criteria for acceptable erosion and sediment control plans should be developed in cooperation with RCD, City and County Building Departments and ACFC&WCD. There would be minor start-up cost to develop criteria and minor on-going administration cost. Enforcement cost to all jurisdictions would be offset by permit and inspection fees. A series of workshops would be conducted to explain the erosion control ordinance to developers, contractors and to the agricultural community.

3. Investigation to Improve Public Works Construction, Maintenance and Operation Practices. A number of public works construction, maintenance and operation practices could be altered if water quality objectives were incorporated in their planning, for example:

   a. Fire and weed control - Methods commonly used include spraying with oil or herbicides, discing (turning into the soil), and scraping. These all have adverse effects with regard to water pollution and should be replaced by mowing to the maximum extent feasible and consistent with plan objectives.

   b. Maintenance of road cut and fill slopes - Such slopes should be landscaped and/or stepped to prevent erosion.

   c. Many other areas of improvement will suggest themselves to public works personnel once water quality objectives are seriously considered.

F. Control Runoff from Contaminated Areas

1. Detention and/or Treatment of Runoff from areas known to contain signigicant concentrations of potential contaminants will prevent runoff from the contaminated area from combining with the relatively clean runoff from the surrounding locale. The cost of diversion and/or detention facilities would be borne by the landowner or developer through the building permit process. Building Codes should be reviewed and revised to allow Building Inspection Departments to have the developer provide required facilities.

2. Investigation of Directing Runoff Away From Contaminated Areas consists of constructing ditches, berms, drainage conduits and/or other devices to collect or divert runoff from areas which contain large amounts of potential pollutants. This measure is primarily directed toward new development. There are numerous industrial areas along the western edge of the Bay Plain in the County where modest expenditures on perimeter berms and drains would be effective in reducing the contamination of runoff. This measure calls for the identifying areas and developing appropriate strategies in coordination with cities and County.

G. Control Direct Discharges Into Storm Drains

1. Implementation of an Oil Recycling Disposal Program when fully operational could significantly reduce the problem of crankcase oil being disposed of into storm drains. This measure is a multiple purpose action in that it not only enhances water quality by elimination of a major source of oil and grease, but it is a very visible action that the public can see. Therefore, the major effort for this measure is education and dissemination of brochures, etc. Cost for this measure is covered in Measure B-1 "Implement Public Information and Education Programs." County Planning Department will act as lead and coordinator in this program. State Senate Bill #68 prescribes requirements for such a program and places administration for it on the State Soild Waste Management Board.

2. Enforcement of the Prohibition on Dumping or Discharging Into Inlets requires a reprioritization of enforcement activities through a policy directive by jurisdictions. When violators are caught they should be prosecuted. The major responsibility for enforcement falls on the Sheriff and City Police Departments and County District Attorney. A positive attitude change in potential offenders through education and not enforcement efforts is the best long-range solution. A vigorous regional educational approach needs to be developed with local cooperation.

H. Investigate Additional Catchbasins and Inlet Cleaning

Most Public Works agencies report that they are currently cleaning inlets - although primarily for blockage that would impede the flow of stormwaters. This measure calls for cleaning inlets with water quality objectives in mind as well as drainage; therefore, the standard at this time is assumed to be at least twice during the rainy season (preferably September and

January). This standard is to be tested in the Castro Valley 208 Demonstration Project (Control Measure B-5). The additional cost for this measure is to be added to existing Public Works Budgets.

I. Investigate Additional Storm Drain Channel Cleaning.

This measure is currently being done by ACFC&WCD, County Road Department and cities for channels in their jurisdiction. With the expansion of jurisdictional control by ACFC&WCD to all flood control channels through adoption and enforcement of the Water-Course Protection Ordinance (Control Measures C-1 and C-2) it is assumed that added responsibility for cleaning channels will be placed upon the Flood Control District. The cost for additional levels of effort is high. This measure will effectively shift some of cities' practices and associated cost to the Flood Control District.

J. Control Contaminants from Domestic Animals.

1. Activate Animal Management Advisory Commission. This commission is proposed for the unincorporated area of the County to utilize the office of the County Field Services Department, Animal Control Division, and/or the U.C. Cooperative Extension for staff assistance. It is assumed that this commission would propose necessary ordinance modifications and set policies and guidelines to control animal management. The costs to establish this commission are estimated as minor.

M. Evaluate Agricultural Chemical Use Practices

A review of the existing program administered by the County Agricultural Commissioner is proposed.

N. Investigate Hazardous Material Spill Program.

It is proposed to initiate a study of accidental spills of hazardous material with the idea of patterning it after Caltrans' program. It is anticipated this will be a program affecting all road agencies in the County.

O. Investigate Exfiltration Problems.

Monitoring on Castro Valley Creek and Glen Echo Creek and in most every other stream in the County indicates bacteria concentration exceeds standards set for swimming. Further study is needed to document if these are caused by exfiltration from sanitary sewers. It is expected that major emphasis for this study would rest with the County Environmental Health Department with assistance from 208 Management staff. This measure is to be studied under the Continuing Planning Process, Phase II of this plan. The cost and approach to dealing with this problem is not known at this time and is to be determined during Phase II.

R. Investigate Non-Local Funding Sources.

This entails a local and regional effort to study fiscal mechanisms other than the local property tax. Examples of other possibilities are the state gasoline tax, revision of service agreements with Caltrans and/or assistance

from EPA, or Congressional appropriations for localities to achieve the goal of P.L. 92-500. The cost of this measure is included in the management staff cost. If non-local funds prove available, implementation of additional service levels may proceed more quickly.

S. Develop Anti-Litter Program.

It is intended that a study be developed by the Solid Waste Management Joint Powers Authority (SWMJPA) to determine means of reducing litter and trash that finds its way into the water courses. In 1977, Senate Bill 650 provides funding to local governments for anti-litter programs.

U. Investigate Neighborhood Composting Programs.

Another task for the SWMJPA is to find means of reducing the vegetative material that gets dumped into the watercourses. This program is to be developed in close coordination with Cities and County.

V. Develop Program of Agricultural Erosion Control.

The United States Department of Agriculture, Soil Conservation Service (SCS) has for a long time developed methods for agricultural erosion control. One reason that SCS methods (administered by the County Resource Conservation District) have not been as effective as they could be has been dependent upon the voluntary compliance of agricultural operators to practice conservation measures. With a certain amount of investigation into other non-voluntary and/or incentive methods of implementation a more effective erosion control program is believed feasible. The program would be administered by the Resource Conservation District (RCD) given additional staffing. The incentives to Agricultural Operators is planned to be in the form of Federal assistance to partially compensate for implementing approved Conservation Plans. A Conservation Plan designed by the RCD and mandated by County Ordinance may prove feasible if current legislation in Congress (i.e., SB-1952, SB-1280 and HB-3199) is passed and funded. Other possibilities include Zoning restrictions to prohibit inappropriate agricultural practices in certain sensitive areas, restrictions on stock animals within some minimum distance from designated watercourses, and increased educational efforts directed at agricultural operations. Investigation of agricultural erosion control implementation methods should be coordinated by the RCD in cooperation with other concerned agencies. Implementation of this measure is proposed for development in the Continuing Planning Process, Phase II of the plan.

W. Investigate Use of Stormwater Detention Facilities.

Further investigation is necessary to assess this measure. It is felt that detention facilities would work well to reduce peak flows and to entrap sediments. Study is needed to be site specific for Alameda County's watersheds. It is proposed that the Flood Control District pursue this measure. The control of this measure is included in the management staff cost.

Y. Establish Animal Management Standards.

This is to be worked on by the Animal Management Advisory Commission, (see Control Measure J-1) with staff assistance from the Farm Advisor and RCD the advisory services of other County, State and Federal Agencies. Public Hearings would be held to explain the process for rural residents.

CASTRO VALLEY 208 DEMONSTRATION PROJECT

This is an experiment to be established in the Castro Valley Watershed to test the effectiveness of the Best Management Practices (BMP) concept. The results of the experiment are to be used to determine the appropriateness of implementing the higher cost control measures (catch basin cleaning, increased street sweeping, etc.). The BMP's selected for evaluation will be tailored and applied to the site specific conditions in this watershed. This study area has been chosen because it has more usable storm runoff management data (i.e., historical quality data; structural and recreational cost data; street sweeper effectiveness values; and, street surface pollutant accumulation rates) than any other watershed in the San Francisco Bay Region.

The design of the applied research will utilize accepted standard methods of data collection, systematic analysis and results reporting. The general relationship to be investigated is to determine if a statistically significant positive effect of applied BMP's can be demonstrated on Castro Valley instream water quality. The research will be conducted over a three-year period. The management practices will be phased-in over these years to determine cost and effectiveness. It is believed that this applied experimental research or trial implementation is a course of action which will guide the application of a series of management practices throughout the County to mitigate stormwater pollution and provide an adequate alternative to end-of-pipe treatment.

This test of the non-structural or source-control approach will attempt to quantify the management action-impact relationship. Although the design does not allow effectiveness values to be determined for each individual control, it does permit quantification of water quality benefits as a result of first, an effective litter control program, second, an improved drainage system cleaning and third, an improved street sweeping system. Results of this experiment will produce knowledge that will be generally applicable to other watersheds within the County. The transferability of this knowledge is thus, an important goal.

The following summarizes the structure of the Castro Valley Experiment:

Year 0-1 Monitor storms with automatic samplers. Develop operational program for next rainy season work tasks.

Year 1-2 Continue monitoring storms. Implement: (1) watercourse protection ordinance (C-2); (2) oil reclamation and education program (G-1); (3) strategic inlet cleaning (H); and (4) storm drain cleaning in September and January. Enforcement (of the Watercourse Protection Ordinance) would be provided by cooperative agreements or County personnel. All violators would receive citations as a notice to desist and a mandatory minimum fine. Output would consist of a report documenting enforcement efforts, water quality data, analysis of mathematical simulation model output and evaluation of water quality responses.

Year 2 & 3 Continue monitoring storms. Continue 1978 program. Implement: (1) execute public information program regarding the relationship between on-street parking and water quality; (2) institute parking restrictions during street cleaning operations; (3) provide residential street sweeping frequency of 1 pass per week between September 15 and April 15 with a mechanical, brush-type sweeper; and (4) enforce erosion controls on any development occurring in the watershed.

Output would maintain same format as previous years. In the evaluation, mention would be made of lag-time effects. Effectiveness of resulting Castro Valley data on other watersheds would be demonstrated by simulation hydrologic modeling to determine the appropriateness of similar "Best Management Practices" being initiated in other portions of the County. Cities would prepare action plans discussing to what extent they will increase the areas covered by parking restrictions and what schedule adjustments are necessary.

COORDINATION - Paramount in the method of study was the concern for coordination among those involved in developing the local plan. The various participants involved in producing the plan were: The County Planning Department, Alameda County Flood Control and Water Conservation District, U.S. Army Corps of Engineers, Soil Conservation Service (SCS), County Resource Conservation District, ABAG, Woodward/Clyde Consultants, and a County 208 Coordinator.

The Corps has been conducting an "Urban Study" for the Upper Alameda Creek Basin. This basin comprises the Livermore Valley area of Alameda County and also called East County in this plan. The major objective of the Urban Studies Program is to use the Corps, working in partnership with local and state governments, to develop realistic plans to help solve water and land related problems. The 1972 Water Quality Act authorizes the Corps to provide planning assistance to states and regional urban bodies upon request. In 1976, ABAG requested the Corps to coordinate their surface runoff study in Alameda County with that of ABAG and the County. The Corps contracted with SCS as a consultant for the agricultural practices element. There has been a large degree of interface between the Corps and the County in developing control measures to be included in the plan.

Woodward/Clyde Consultants were hired to provide day to day guidance, interpretation of computer model results, and expert, state of the art technical guidance on selection of control measures.

The Alameda County Flood Control District acted as lead agency in coordinating the efforts of various agencies and in writing the plan. The District retained a consultant, Mr. Gary W. Shawley, to be the County's "208 Coordinator". To a large degree, the actions proposed in the plan are a result of the coordination of involvement of the numerous participants. It is anticipated that many refinements and contacts will be necessary to develop the final version of the plan. It is expected that in the continuing planning process the degree of coordination in the annual plan update/process will continue to be an important factor. The continuing planning process is the "feedback" element within the plan from which, when new information is gained, it is used to further refine the plan.

TOOLS AND DATA - Another element in the study method was the "tools" employed. There were a number of tools used such as: two different mathematical computer programs, physical and chemical analyses of storm and non-storm water quality samples. physical and chemical analyses of street dust and dirt accumulations, and opinion surveys of knowledgeable technical persons.

One computer program used extensively to estimate annual surface runoff pollutant loadings was the "Macroscopic Planning Model" (MAC). Table 3 presents surface runoff mas emissions compared to Sewage Treatment Plat emissions from Alameda County entering San Francisco Bay for 1975. This "model" is more accurately described as a computer program which substitutes as a manual seasonal "accounting" tool rather than as a "model" which connotes a simulation ability. The other computer program, the Stromwater Management Model (SWMM), was developed by EPA, and is a true simulation model. Little use was made of this tool, but it is expected to be more useful in the continuing effort. Modeling may be used extensively in the Castro Valley Demonstration Project and CPP.

Three types of data were used for input into the "modeling" efforts to quantify the loadings and to evaluate some of the control measures. A storm water monitoring effort was initiated by the County in Fiscal Year 1976-77 at two locations (Glen Echo Creek in Oakland and Castro Valley Creek in Castro Valley). These were selected to be as representative of other County watersheds as possible. Despite the second year of the drought, these stations produced a considerable amount of usable water quality data. Other stormwater data collected by the U.S. Geological Survey (USGS) between 1972-75 at the Castro Valley site was also used. A cooperative agreement was arranged among the Corps, USGS, and the District to continue the Castro Valley site in 1976-77 at no cost to the 208 program. Because of this cooperation, this monitoring station now has more usable stormwater data than any other site in the San Francisco Bay Region. Stormwater data was also collected sporadically for two years (1972-74) on Peralta Creek in North County and used for comparison with the data gathered at the Glen Echo site.

The second type of data used was non-storm (i.e., dry weather flow) water quality data collected since 1972. The use of the non-storm water quality data was to attempt to estimate the ambient or non-storm water quality characteristics of County interior waters.

The third type of data used in the efforts to (a) quantify pollutant loadings and (b) evaluate particular control measures was street dust and dirt accumulation data. Table 5 compares national versus Alameda County accumulation rates.

TABLE 5

STREET SURFACE
ACCUMULATION RATES
COMPARISON WITH NATIONAL VALUES

	LBS/CURB MILE		
	Residential	Commercial	Industrial
National (1)	1,200	360	2,800
Alameda Co.	350	265	1,910
(average range)	100-835	164-357	1,470-2,670

(1) Source: Sartor & Boyd - 1972
(2) County data was collected during May and June 1977 at end of the rainy season.

Early into the stormwater monitoring effort in 1977, it appeared evident that a contingency plan to collect data was necessary because the drought made rainfall events and thus stormwater data collection rather infrequent. As a result of the contingency plan, an experiment was established to: (1) produce locally generated data to aid in "model calibration"; (2) obtain locally observed street surface contaminant loading rates; (3) determine effectiveness of local street sweeping programs; and (4) involve cities in problem identification and solution evaluation.

This experiment proved valuable for four reasons: (1) Chemical and biological analysis of the data confirmed the presence of large amounts of heavy metals, nutrients, coliform and fecal coliform bacteria residing on street surfaces; (2) Local effectiveness values of one control measure were able to be better estimated; (3) City technical staff were involved in "208" field work and the message of cleaning up stormwater pollution was heard at the operational staff level; and (4) County staff were convinced of the value of using local data rather than national average data especially insofar as using control measure effectiveness values.

All of the above "tools" and data were used to identify and document the problem and to evaluate candidate control measures. It is assumed that (a) if the measured presence of a pollutant in a watercourse exceeds established standards, then that pollutant is a problem; and (b) if a beneficial use of a water body is constrained or impaired as a result of quality degradation by strom runoff, then that limitation of use also constitutes a problem. Where water quality standards exist for nutrients and bacteria, the concentrations found in Alameda County surface waters far exceed set standards. It must be stated, however, that the problem's cause-effect relationship is not well understood. The extent of this problem identification is presented first in the narrative on Page II - land recorded in a matrix in Table 4.

CONTROL MEASURES EVALUATION - The candidate controls were evaluated by six basic methods. These were: (1) through an extensive literature search by ABAG and the District; (2) through consultations with nationally recognized experts (i.e., Metcalf and Eddy Consultants and Woodward/Clyde Consultants); (3) actual field tests to determine existing real-world effectiveness values for local street sweepers; (4) computer runs using EPA's "SWMM: model; and (5) local control measures surveys; (6) conferences with Resource Conservation District and S.C.S. personnel.

A comprehensive list of candidate control measures was researched from EPA publications and proposed by ABAG for consideration by the eight Bay Area Counties. An assessment process was established to determine which of the measures were appropriate and effective to the local situation. In Alameda County this process consisted of the following three elements. First, on a technical staff level the 208 Technical Advisory Group considered which of the measures they believed to be applicable to their representative areas.

Also, personal interviews were conducted with staff members of City and County Public Works and Planning Departments to estimate effectiveness of existing practices. Second, the public's perspective regarding effectiveness and social impacts was gained through "Regional Roundtable" and County public participation meetings. Third, District consultants evaluated the proposed controls on the basis of (a) the most cost-effective technical solution (e.g., unit costs per pound of pollutant removed), and (b) politically acceptable and equitable cost arrangements.

During the candidate controls assessment, it was documented that very little quantitative data exists on effectiveness values for most of the controls evaluated as appropriate. Of all the controls proposed for implementation in the plan, useful quantitative effectiveness values tailored to local conditions exist only for street sweeping and some erosion control methods. For example, more frequent cleaning of inlets, catch basins and drainage channels would remove all of the material which is collected from contaminating runoff. The principal researchers

in the field of urban runoff control agree that this is one of the most effective candidates available, yet there does not exist any data regarding what portion of the overall problem this measure would affect. Therefore, a procedure is proposed which will produce local effectiveness values for the recommended controls. This procedure is the "Castro Valley 208 Demonstration Project described on page III-13. The purpose of the experiment is to test the effectiveness of an array of Control Measures in order to determine effectivenss values for categories of control measures (e.g., modified street sweeping).

Futher clarification of the concepts used in the consultant's screening procedure is found in the Woodward/Clyde Consultants' recommendations in the Support Document.

The Assessment process in determining recommended controls was not an alternative development process but more of an elimination process. That is, some controls were not appropriate (as regards effectiveness, e.g. repair of streets) and as the process evolved, best management practices were found to be existing urban hygiene services. Greater control of surface runoff thus meant increasing these service levels if financing can be arranged.

PUBLIC INVOLVEMENT - County Planning Department was responsible for involving the General Public. Public participation in the Environmental Management Process, which includes the Surface Management Plan, included:

- Two ABAG sponsored regional roundtable meetings
- One meeting of Alameda County Citizens Committee
- Three meetings of East County, one each North and South County Citizens Committee.

Future meetings of the three groups are planned.

Alameda County Planning Department and the Flood Control District presented the Environmental Management Plan program to the County Planning Commission, twelve city councils, three special districts, and the Army Corps of Engineers' Upper Alameda Creek Basin Citizens Committee.

City Councils and Special Districts appointed members and alternates to the North and South Citizens Committees and the Army Corps of Engineers' Upper Alameda Creek Basin Citizens Committee serves as the Environmental Management Citizens Committee.

These groups are staffed by the Planning Department, and at each meeting the Planning Department and Flood Control District staff members discussed plan and programs.

Citizen Committee recommendations on the County Surface Management Plan for Alameda County are:

RECOMMENDATIONS

The Committee unanimously endorses and is committed to the basic concepts and goals put forward in the Surface Runoff Plan, namely, the attainment of cleaner water and air in Alameda County, and further, the Committee recommends:

1. That existing local governments be encouraged to set up programs and sites for the collection of recyclable materials including oil.

2. That additional surface runoff monitoring and sampling programs should be implemented in those areas of the County where indicated necessary and feasible, avoiding duplication.

3. That surface runoff problem areas should be identified by existing County and other agencies in cooperation with the lead agency, the Alameda County Flood Control and Water Conservation District, and that jurisdictions which have significant surface runoff problems should be encouraged to solve problems originating in their jurisdiction.

4. That the Surface Runoff Management Plan for Alameda County be reviewed once a year, or as necessary, and that a Citizens Committee be activated to conduct the review. During this Plan review, specific attention should be given to the Control measures, Priorities, Funding Sources and Funds Expended.

5. That additional funding sources be sought to expand the first year monitoring program, and that at this time it is recommended that additional monitoring be implemented in succeeding years as necessary to define surface runoff problems.

6. That the public be made aware of the locations and properties of locally stored hazardous wastes and the agency(ies) responsible for safeguarding the public's health with respect to hazardous wastes, particularly in relation to contamination of public water resources.

Because the three groups represent varied interests, the recommendations from each meeting are included.

<u>South County</u>

1. That there be continuous data collection and monitoring of pollutants in urban and agricultural land use watersheds in Alameda County.

2. That a demonstration project be funded to test alternative surface runoff pollution abatement measures and associated costs; that this controlled experiment be conducted on an Alameda County watershed and that costs of this demonstration be supported by funding sources other than local property taxes.

3. That there be periodic presentations of environmental (especially surface runoff) problems and alternative solutions to the general public through the public media.

4. That a litter control program (similar to the Hayward program) be evaluated for effectiveness and Countywide implementation.

5. That a model program of instruction for evaluating biological, chemical and pathogenic surface water pollutants be evaluated for use in schools, such as the Hayward Unified School District.

<u>North County</u>

1. That precise measurements of pollutants are important at this time for determining the source and types of contaminants, as well as the specific controls and ordinances required to abate surface runoff sources of pollution.

2. That the sources, quantities and rates of sediment origin, transfer and deposit be determined.

3. That significant progress in controlling bacteria can be achieved through eliminating cross connections and infill/exfiltration between the storm draining and sanitary system.

4. That the following forms of surface runoff pollution be considered for evaluation and abatement:

    - Animal wastes in the streets.

    - Crankcase oil being poured into storm drains.

    - Wastes from cleaning paint brushes being dumped into storm drains.

5. That demonstration projects, such as the proposed Castro Valley experiment, be identified and integrated with related community development and improvement programs such as air quality maintenance, neighborhood conservation, aesthetic concerns, litter control, recycling (e.g., bottle recycling legislation), chemical free pest control in public areas, local employment opportunities, and that such projects be strictly controlled for obtaining useful data.

6. That the quantity of nutrients entering receiving waters be controlled so as to minimize algae blooms.

7. That the potential effects of hazardous wastes and spills of these materials in the environment be studied and evaluated.

8. That costs for reducing surface runoff pollution to San Francisco Bay should be related to benefits, and that costs be shared on a regional basis.

9. That the storm drainage system (catchbasins, inlets and the channels) be cleaned more often.

   (These are individual, rather than group, recommendations.)

East County

1. Encourage people to conduct good range management practices. This requires constant education of people in order for them to really understand what needs to be done.

2. Cattle should not be let onto grazing grounds until there exists a state of grazing readiness.

3. All public agencies owning land, particularly range land should act as examples in demonstrating good land management practices.

4. Encourage the Resource Conservation District and their Board of Directors to pursue a vigorous cooperative conservation program for range management. Encourage the use of the following best management practices as outlined in Table 6. The source of Table 6 is the Phase II report from the Soil Conservation Services' Report to the Corps of Engineers for the Upper Alameda Creek Basin Urban Study.

TABLE 6

LIST OF BEST MANAGEMENT PRACTICES
FOR THE UPPER ALAMEDA CREEK BASIN RURAL AREA

Practice Name	SCS SPECIFICATION NO.	DESCRIPTION
Access Road	560	Roads for access to farms, ranches, fields, recreation areas
Agricultural Waste Management System	312	Management of liquid and solid waste, including runoff from concentrated areas
Agricultural Waste Storage Facility	313	Structure for temporary storage of animal or other agricultural waste
Brush Management		Brush control by mechanical, chemical, biological or other means
Chiseling and Subsoiling	324	Improved water and root penetration
Conservation Cropping System	328	Crop rotation
Contour Farming	330-A	Plowing, preparing land, planting and cultivation on contour
Contouring Orchard and Other Fruit Areas	330-B	(See 330-A)
Cover and Green Manure Crop		Seasonal protection of bare soil and soil improvement
Critical Area Planting	342	Soil stabilization, improvement of habitat and aesthetics
Crop Residue Use	344-A	Field protection with plant residues
Dam, Diversion	348	Diversion of water for beneficial use
Dam, Multi-Purpose	349	Water retention and floodwater retardation
Debris Basin	350	Silt and sediment basins
Deferred Grazing	352	Resting of grazing land
Disposal Lagoon	359	Biological waste treatment ponds
Diversion	362	Diversion of water for soil protection
Emergency Seeding of Burned Areas		Soil stabilization and flow reduction by seeding

TABLE 6 (Ctd.)

Practice Name	SCS SPECIFICATION NO.	DESCRIPTION
Fencing	382	Live stock management and restriction
Field Border	386	Strip of perennial vegetation around field
Grade Stabilization Structure	410	Prevention of erosion and gullies
Grassed Waterway or Outlet	412	Vegetation for channel stabilization
Heavy Use Area Protection	561	Vegetative or physical covering
Hillside Ditch	423	Reduce unbroken slope lengths to minimize erosion
Holding Pond	425	Storage of liquid and solid waste and polluted runoff
Irrigation Land Leveling	464	Provide uniform irrigation and adequate drainage
Irrigation System (Drip, Sprinkler, Surface and Subsurface	440-A, 443, 445	Planning and design of irrigation systems
Irrigation System, Tailwater Recovery	447	Recycling irrigation runoff
Irrigation Water Management	449	Efficient, beneficial use of irrigation water
Lined Waterways or Outlet		Physical stabilization of channels
Livestock Exclusion		Elimination of grazing in critical areas
Minimum Tillage	478	Limiting and timing of tillage
Mulching	484	Application of imported plant residues
Open Channel	582	Construction or modification of channels
Pasture and Hayland Management	510	Improvement of forage, soil protection, flow reduction
Pasture and Hayland Planting	512	Establishment of animal forage

TABLE 6 (Ctd.)

Practice Name	SCS SPECIFICATION NO.	DESCRIPTION
Planned Grazing System	556	Rangeland and pasture management
Pond	378	Water retention and storage
Proper Grazing Use	528	Grazing management
Range Seeding	550	Establishment of range forage
Reclamation of Surface Mined Areas	328	Restoration of disturbed land surfaces
Recreation Area Improvement	562	Vegetation modification in recreation areas
Recreation Land Grading and Shaping	566	Altering land surface for recreational use
Recreation Trails	568	Design and construction of pathways
Spring Development	574	Water supply development
Stock Trails and Walkways	575	Improvement of grazing distribution and access to forage and water
Stream Channel Stabilization	584	Structural channel stabilization
Streambank Protection	580	Vegetative or structural bank protection
Strip Cropping	585-B	Alternating crops in strips across slope
Stubble Mulching	334-B	Managing dry land plant residues

TABLE 6

CONSTRUCTION SITE SEDIMENT CONTROL

Best Management Practice	Description
Land Use Control	Zoning of critical areas to open space or recreation
Site Selection	Selecting areas with favorable drainage, topography and soils
Site Planning	Fitting the development to the site
Phasing Construction	Developing an area in small workable units
Construction Scheduling	Scheduling critical grading during the dry season
Minimum Grading	Minimum removal of natural vegetation
Runoff Control	Directing and diverting of runoff to prevent erosion
Critical Area Protection	Temporary protection of critical areas with cover crops or structures
Sediment Basins	Construction of temporary sediment traps
Housekeeping	Maintaining the site and drainage conveyances free of excess construction debris and litter
Runoff Disposal	Off-site planning for increased runoff and runoff disposal
Landscaping	Permanent vegetation and structures for erosion prevention at completed projects

VI. ASSESSMENT SUMMARY OF INITIAL PLAN CONTROL MEASURES

TABLE 3

CONTROL MEASURE	AIR QUALITY	WATER QUALITY
A.2. Regulate Land Use in Sensitive Areas	N/A	Lessens mass emission rates, Benefits water quality. Favors beneficial uses.
C.1&2. Adopt and Enforce Watercourse Protection Ordinance	Reduction of odors.	"
D.1&2. Draft and Implement Operator Training Program	Minor increase in dust generation during sweeping. Overall reduction of ambient dust levels.	"
D.3. Expand Parking Controls	Minor increase in dust generation during sweeping. Overall reduction of ambient dust levels.	"
D.4. Increase Street Cleaning Services	Minor increase in dust generation during sweeping.	"
E.2. Revised Grading and Fill Ordinances for Urban and Rural Areas.	Minor decrease of emissions and dust during construction.	"
G.1. Implement Oil Recycling/ Disposal Program	N/A	"
G.2. Enforce Prohibition on Dumping or Discharge Into Inlets	Minor odor reduction.	"
H. Clean Catchbasins and Inlets	Controls odors (some short-term increase). Cleaning equipment emissions.	"
I. Clean Storm Drains and Drainage Channels	Controls odors (some short-term increase). Cleaning equipment emissions.	"

Note: Administrative measures are not assessed separately, but are considered within the assessment of the practices and ordinances. Related control measures with similar impacts are grouped together.

TABLE 7 (cont.)

CONTROL MEASURE	PHYSICAL RESOURCES	ENERGY
A.2. Regulate Land Use in Sensitive Areas	Negligible	N/A
C.1&2. Adopt and Enforce Watercourse Protection Ordinance	Minor increased demand on waste disposal site capacity.	N/A
D.1&2. Draft and Implement Operator Training Program	Minor increased demand on waste disposal site capacity.	Negligible
D.3. Expand Parking Controls	Minor increased demand on waste disposal site capacity.	Negligible
D.4. Increase Street Cleaning Services	Minor increased demand on waste disposal site capacity.	Additional fuel consumption by sweepers.
E.2. Revised Grading and Fill Ordinances for Urban and Rural Areas.	Protects land and related resources, flora, and fauna.	Fuel required during some construction efforts.
G.1. Implement Oil Recycling/ Disposal Program	Conserves petroleum resources.	Conserves energy resources.
G.2. Enforce Prohibition on Dumping or Discharge Into Inlets	Increased demand on waste disposal site capacity.	N/A
H. Clean Catchbasins and Inlets	Increased demand on waste disposal site capacity.	Fuel required to operate cleaning equipment.
I. Clean Storm Drains and Drainage Channels	Increased demand on waste disposal site capacity.	Fuel required to operate cleaning equipment.

TABLE 7 (cont.)

CONTROL MEASURE	AMENITIES	FINANCIAL
A.2. Regulate Land Use in Sensitive Areas	Negligible	Minor cost to develop and administer program.
C.1&2. Adopt and Enforce Watercourse Protection Ordinance	Benefits visual amenities.	Costs for inspection and enforcement.
D.1&2. Draft and Implement Operator Training Program	Benefits visual amenities.	Minor cost for designing and implementing training program.
D.3. Expand Parking Controls	Benefits visual amenities.	Significant cost for installing and maintaining signs and conducting enforcement program. Enforcement program may not be offset by fines.
D.4. Increase Street Cleaning Services	Benefits visual amenities. Increase in noise during operation.	Significant added cost. More labor, equipment, maintenance.
E.2. Revised Grading and Fill Ordinances for Urban and Rural Areas.	Beneficial or adverse visual impact depending on design.	Cost to administer and enforce new requirements. Covered by permit fees.
G.1. Implement Oil Recycling/ Disposal Program	N/A	Cost to establish and administer program.
G.2. Enforce Prohibition on Dumping or Discharge Into Inlets	Improves visual amenities.	Minor cost for additional enforcement effort.
H. Clean Catchbasins and Inlets	Noise generated during cleaning.	Moderate to high capital and operating costs.
Clean Storm Drains and Drainage Channels	Noise generated during cleaning.	Moderate to high capital and operating costs.

TABLE 7 (cont.)

CONTROL MEASURE	INSTITUTIONAL	PRODUCTION OF GOODS & SERVICES
A.2. Regulate Land Use in Sensitive Areas	Potential resistance from landowners and developers.	N/A
C.1&2. Adopt and Enforce Watercourse Protection Ordinance	Requires cooperation and coordination among jurisdictions.	Minor employment opportunities.
D.1&2. Draft and Implement Operator Training Program	Need for coordination among public works departments.	Negligible
D.3. Expand Parking Controls	Probability of public resistance. In areas lacking adequate off-street parking this measure would probably not be feasible. Demand for coordination among governmental units.	Demand for manufacture, sale, and installation of signs. Minor employment opportunity from increased enforcement.
D.4. Increase Street Cleaning Services	Direct competition with other public services for limited funds.	Employment opportunities resulting from additional shifts. Increased demand for sweeping equipment.
E.2. Revised Grading and Fill Ordinances for Urban and Rural Areas.	Demand for coordinating construction inspection and enforcement.	Minor employment opportunities.
G.1. Implement Oil Recycling/ Disposal Program	Need to coordinate program among Cities and County.	Minor decrease in demand for new oil. Increase demand for oil recycling facilities.
G.2. Enforce Prohibition on Dumping or Discharge Into Inlets	Need for coordination between public works and law enforcement departments.	N/A
H. Clean Catchbasins and Inlets	Direct competition with other public service for limited funds.	Minor employment opportunities.
I. Clean Storm Drains and Drainage Channels	Direct competition with other public services for limited funds.	Minor employment opportunities.

BLE 7 (cont.)

CONTROL MEASURE	INCOME AND INVESTMENT	CONSUMER EXPENDITURES	HOUSING SUPPLY
A.2. Regulate Land Use in Sensitive Areas	Negligible	Negligible	N/A
C.1&2. Adopt and Enforce Watercourse Protection Ordinance	N/A	N/A	N/A
D.1&2. Draft and Implement Operator Training Program	N/A	N/A	N/A
D.3. Expand Parking Controls	N/A	N/A	N/A
D.4. Increase Street Cleaning Services	N/A	N/A	N/A
E.2. Revised Grading and Fill Ordinances for Urban and Rural Areas.	Could result in minor benefit to property values.	Minor cost increase to cover erosion control expenditures.	Could raise cost of housing or reduce supply in erosion-prone areas.
G.1. Implement Oil Recycling/ Disposal Program	N/A	N/A	N/A
G.2. Enforce Prohibition on Dumping or Discharge Into Inlets	N/A	N/A	N/A
H. Clean Catchbasins and Inlets	N/A	N/A	N/A
I. Clean Storm Drains and Drainage Channels	N/A	N/A	N/A

TABLE 7 (cont.)

CONTROL MEASURE	PHYSICAL MOBILITY	HEALTH AND SAFETY	SENSE OF COMMUNITY
A.2. Regulate Land Use in Sensitive Areas	N/A	N/A	N/A
C.1&2. Adopt and Enforce Watercourse Protection Ordinance	N/A	Reduction of fire hazards, disease vector, mosquito and aquatic insect & pest problems.	Negligible
D.1&2. Draft and Implement Operator Training Program	N/A	Negligible	Negligible
D.3. Expand Parking Controls	Potential temporary inconvenience.	Negligible	N/A
D.4. Increase Street Cleaning Services	N/A	Negligible	Negligible
E.2. Revised Grading and Fill Ordinances for Urban and Rural Areas.	N/A	N/A	N/A
G.1. Implement Oil Recycling/ Disposal Program	N/A	N/A	N/A
G.2. Enforce Prohibition on Dumping or Discharge Into Inlets	N/A	Reduction of fire hazards and disease vector problems.	Negligible
H. Clean Catchbasins and Inlets	N/A	Reduction of fire hazards and disease vector problems.	N/A
I. Clean Storm Drains and Drainage Channels	N/A	Reduction of fire hazards, disease vector, mosquito and aquatic insect & pest problems.	N/A

TABLE 7 (cont.)

CONTROL MEASURE	EQUITY	URBAN LAND USE PATTERNS
A.2. Regulate Land Use in Sensitive Areas	Cost would be borne by polluter.	Negligible
C.1&2. Adopt and Enforce Watercourse Protection Ordinance	Punishment borne by offenders.	N/A
D.1&2. Draft and Implement Operator Training Program	N/A	Negligible
D.3. Expand Parking Controls	N/A	Negligible
D.4. Increase Street Cleaning Services	N/A	Negligible
E.2. Revised Grading and Fill Ordinances for Urban and Rural Areas.	Cost of control borne by landowner.	Increased site development cost in erosion-prone areas could constrain development
G.1. Implement Oil Recycling/ Disposal Program	N/A	N/A
G.2. Enforce Prohibition on Dumping or Discharge Into Inlets	Penalties assessed to violators.	N/A
H. Clean Catchbasins and Inlets	N/A	N/A
I. Clean Storm Drains and Drainage Channels	N/A	N/A

Contra Costa County
SURFACE RUNOFF MANAGEMENT PLAN

Final Draft

October 14, 1977

The preparation of this report was financed in part through an areawide waste treatment management planning grant from the Environmental Protection Agency, Region IX, under the provisions of Section 208 of the Federal Water Pollution Control Act as amended.

TABLE OF CONTENTS

Maps and Figures

I. INTRODUCTION

A. PREFACE

In response to the Water Pollution Control Act Amendments of 1972, Section 208, the Environmental Protection Agency (EPA) has provided grants for water quality planning throughout the nation. In "non-designated" areas, largely rural, the state is doing this work. In the nine-county Bay Area, a "designated" area, the governor has assigned the Association of Bay Area Governments (ABAG) to do this work. At approximately the same time as 208 was getting started, another Bay Area Task Force was beginning an Air Quality Maintenance Plan, as required by federal and state governments for areas designated as Critical Air Basins. Through circumstances, the air quality planning effort was incorporated into 208 as an element of the regional Environmental Management Plan. In all, seven plans are being produced, including:

- Surface Runoff
- Other Nonpoint Sources
- Air Quality Maintenance
- Municipal Wastewater Facilities
- Industrial Discharges
- Water Conservation, Reuse and Supply
- Solid Waste, including municipal wastes, hazardous wastes, and wastewater residuals

There is also a requirement for an assessment of the environmental, social and economic impacts of the management plans. This assessment will be the basis for the selection of control measures for the management plans. After hearings and approval by ABAG's General Assembly and Executive Board, the Plan will be submitted to the state for review, and when signed by the governor will be transmitted to EPA. After that occurs the Environmental Management plan becomes part of the State Water Resources Control Board water quality plan for the Bay Area, the Air Quality Plan becomes the State Air Resources Boards' State Implementation Plan for the Bay Area, and the entire plan becomes the Environmental Element of ABAG's Regional Plan.

Six of the plans are being prepared by ABAG, with regional and state governmental agencies. The Surface Runoff Management Plans (SRMP) are being prepared by each of the counties, excepting San Francisco, which has already completed its Surface Runoff Management Plan. The eight county SRMP will be integrated into one regional SRMP with the assistance of the counties, and will retain the integrity of each county SRMP.

This document is the draft SRMP report for Contra Costa County. It was prepared jointly by the County Planning and Public Works Departments. The County's contract with ABAG includes $91,000 for SRMP preparation.

B. LEGAL FRAMEWORK OF 208 AND RELATIONSHIP TO 201

The federal law that has led to the Bay Area Environmental Management Plan (EMP), including this Surface Runoff Management Plan (SRMP), is Section 208 of the Water Pollution Control Act Amendments of 1972 (PL 92-500), which states:

"(b)(1) Not later than one year after the date of designation of any organization under subsection (a) of this section such organization shall have in operation a continuing areawide waste treatment management planning process consistent with Section 201 of this Act. Plans prepared in accordance with this process shall contain alternatives for waste treatment management, and be applicable to all wastes generated within the area involved. The initial plan prepared in accordance with such process shall be certified by the Governor and submitted to the Administrator not later than two years after the planning process is in operation.

"(2) Any plan prepared under such process shall include, but not be limited to -

"(A) the identification of treatment works necessary to meet the anticipated municipal and industrial waste treatment needs of the area over a twenty-year period, annually updated (including an analysis of alternative waste treatment systems), including any requirements for the acquisition of land for treatment purposes; the necessary wastewater collection and urban storm water runoff systems; and a program to provide the necessary financial arrangements for the development of such treatment works;

"(B) the establishment of construction priorities for such treatment works and time schedules for the initiation and completion of all treatment works;

"(C) the establishment of a regulatory program to--

"(i) implement the waste treatment management requirements of section 201(c),

"(ii) regulate the location, modification, and construction of any facilities within such area which may result in any discharge in such area, and

"(iii) assure that any industrial or commercial wastes discharged into any treatment works in such area meet applicable pretreatment requirements;

"(D) the identification of those agencies necessary to construct, operate, and maintain all facilities required by the plan and otherwise to carry out the plan;

"(E) the identification of the measures necessary to carry out the plan (including financing), the period of time necessary to carry out the plan, the costs of carrying out the plan within such time, and the economic, social and environmental impact of carrying out the plan within such time;

"(F) a process to (i) identify, if appropriate, agriculturally and silviculturally related nonpoint sources of pollution, including runoff from manure disposal areas, and from land used for livestock and crop production, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

"(G) a process to (i) identify, if appropriate, mine-related sources of pollution including new, current, and abandoned surface and underground mine runoff, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

"(H) a process to (i) identify construction activity related sources of pollution, and (ii) set forth procedures and methods (including land use requirements) to control to the extent feasible such sources;

"(I) a process to (i) identify, if appropriate, salt water intrusion into rivers, lakes, and estuaries resulting from reduction of fresh water flow from any cause, including irrigation, obstruction, ground water extraction, and diversion, and (ii) set forth procedures and methods to control such intrusion to the extent feasible where such procedures and methods are otherwise a part of the waste treatment management plan;

"(J) a process to control the disposition of all residual waste generated in such area which could affect water quality; and

"(K) a process to control the disposal of pollutants on land or in subsurface excavations within such area to protect ground and surface water quality."

Subsection (b)(1) sets forth the major purpose of 208 planning--to determine needs and plan for wastewater treatment facilities and storm drains needed over the next 20 years. Subsections (b)(2), (F) through (K) set forth the subject matter of 208 planning other than for treatment works, including surface runoff from agriculture, mining and construction sites.

The objective of the Water Quality Control Act is "to restore and maintain the chemical, physical and biological integrity of the Nation's waters." An interim goal of water quality is to provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the water, to be achieved by July 1, 1983. The ultimate objective is that the discharge of pollutants into the navigable water shall be eliminated by 1985. It is not realistic to hope to achieve this ultimate goal, since every drop of water from point and non-point sources would require processing through tertiary treatment facilities resulting in discharges of water from creeks and sewage plants cleaner than undisturbed nature would provide. However, the interim goal of water quality which will provide for beneficial uses, including the maintenance of aquatic life, seems reasonable and is evidently the foundation for 208 studies throughout the nation.

C. OTHER REASONS FOR PREPARING THE PLAN

The State Water Resources Control Board and ABAG have provided other reasons for studying pollution from surface runoff:

1. The "Water Quality Control Plan, San Francisco Bay Basin," prepared for the State Water Resources Control Board and Regional Water Quality Control Board in 1975, hereinafter called the Basin Plan, identifies over 100 bodies of water of concern in the Bay Area, their existing and potential beneficial uses, and some predictions about future water quality conditions. Water bodies in this county are listed in Figure V-A with potential beneficial uses noted in the Basin Plan. A conclusion of the Basin Plan is that secondary sewage treatment plus improved industrial discharges will result in satisfactory water quality throughout the Bays, except possibly the extreme southern end. It should be kept in mind that the Basin Plan dealt primarily with the substances of concern in this program, not chlorinated hydrocarbons and other possibly hazardous chemicals.

2. ABAG's 208 Work Program lists the following additional reasons for preparing Surface Runoff Management Plans:

   - Most non-point pollution results from surface runoff.

   - Runoff from construction activities sometimes affects beneficial uses of water bodies.

   - Pollutant load percentages will increase in the future because of additional urban development and as point source pollution is abated.

   - Surface runoff is a major cause of shellfish contamination.

   - Minimum standards for erosion control, especially related to construction activities were recommended in the Basin Plan for the Bay Area.

   - Control measures for agriculture, silviculture, and mining and construction-related activities are required under Section 208 of the Water Pollution Control Act Amendments of 1972.

   - Runoff is a major source of heavy metal loadings to Bay waters in wet weather.

   - Surface runoff is probably the major source of litter in the Bay and on its shores and mudflats.

Some of the above statements are estimates from the Basin Plan, some are questionable and require substantiation, and some, while they may be true, have not been precisely identified in the SRMP study regarding where the problems are located, and what sources of which pollutants are actually responsible for impairment of beneficial uses.

Note that the items above, given as reasons for preparing this SRMP, are almost all related to surface runoff impacts on the Bays and rivers. The emphasis of the eight County Plans has been on:

- mathematical modeling to estimate present and future loading to the offshore receiving waters from surface runoff, plus monitoring (Section IV B and C).

- investigating local water quality problems in the interior waters of the counties (Section V-D).

Other reasons for preparing this plan are:

- EPA requires a Surface Runoff Management Plan as an element of 208 water quality plans.

- It is known that surface runoff, particularly from urban areas, contains a large number of substances which, in sufficient quantities, are known or strongly suspected to harm life, including fish and other wildlife, as well as man. An attitude of stewardship for the environment requires that this not be ignored.

- Field research is expected to reveal relationships between hazardous substances and environmental health. Many of these effects are long term in nature and cannot be discovered in experiments such as fish survival over a period of a few days in laboratory tanks. The findings may not be available for several years, but it would be tragic to allow permanent damage to the Delta, rivers, and Bays by taking no action until irreversible damage has occurred. Hundreds of man-created chemical substances are used in industry, agriculture, and on home properties. Perhaps only a few will prove to cause cancer, sterility or other diseased conditions, and perhaps even fewer would enter the aquatic food chain in levels above an acceptable minimum. Nevertheless, the economic, recreational and wildlife damages which could occur if striped bass, for example, were rendered unusable or their populations decimated by toxic substances, would be so serious that even a very low risk of such an occurrence should be avoided if possible.

- It is widely reported that people habitually but illegally dump oil, grease, animal wastes, soil, toxic materials and other materials and objects into creeks, flood control channels, storm drains, and along roadsides. Whether or not a direct benefit to the receiving waters could be demonstrated if we refrained from these habits, it is clear that public costs to clean up these areas would be reduced, and damages to the environment, wildlife and aesthetics of local areas would be avoided. It is probable that refraining from illegal littering and dumping would have some beneficial impacts on off-shore waters as well, since part of these materials, perhaps the greater part, is washed out by storm runoff. It is recognized, however, that it is virtually impossible to measure all of the substances illegally dumped, or to determine the precise effects on fisheries and other wildlife--or ultimately, the effects on human beings.

- Loss of soil by water erosion from poorly managed open space areas and from public and private construction projects not only damages property but also requires significant expenditures to repair property and clear or dredge sediments from creeks, flood control channels, and storm drains. Although soil particles themselves are not considered harmful to the

offshore waters, except when concentrated enough to smother shellfish or cause other adverse effects, small soil particles also pick up and carry lead, copper, mercury and other metals, some of which occur naturally and some of which appear to be concentrated in urban areas, primarily from vehicles and industry. Whether or not heavy metals absorbed onto fine soil particles harms aquatic life is now questionable. Scientists report that toxins in the water itself are harmful, not what is attached to solids. All such soil erosion cannot be prevented, but good land practices may yield water quality benefits as well as helping to protect property values and reduce public costs for maintenance, repair and dredging.

- Construction sediments are specifically mentioned in Section 208, demonstrating that Congress believes this is a matter of concern throughout the nation.

- The County has studied water quality to a limited extent according to the terms of the contract with ABAG. The monitoring and modeling programs were designed to give general conclusions regarding the quality of surface runoff today and in the future. The literature search, communications with several County departments, City Engineers, water and park districts, and the Public Participation Committee, produced the identification of potential local water quality problems in specific water bodies and non-critical but widespread conditions which may affect surface waters throughout the county (see Section V).

For the above reasons, this plan recommends a course of action to mitigate water pollution, property damages, public costs, health hazards, nuisances, damages to aesthetic values, and potential environmental damages, which may result from inadequate land and construction practices, illegal littering and dumping, and lack of public awareness. The plan also recommends that studies be undertaken to discover to what extent the substances in surface runoff may have adverse impacts on the beneficial uses of the offshore receiving waters.

D. GOAL AND OBJECTIVES OF THE CONTRA COSTA COUNTY SURFACE RUNOFF MANAGEMENT PLAN

These statements were prepared with the assistance of the County Surface Runoff Management Plan Public Participation Committee and the County's Advisory Task Force. The Public Participation Committee was composed of the three publics identified by EPA:

Government agencies
Special interest groups
The general public

The recommendations of the Public Participation Committee were submitted to the Advisory Task Force, the county's policy body composed of City Managers and Planning Directors, water and sewer districts, County Health and Public Works Departments, ABAG staff, and the Board of Supervisors representative on ABAG's 208 Environmental Management Task Force. The goal and objectives as stated were prepared and approved by the Committee and Task Force.

The goal and objectives, plus advice and direction in plan preparation, were based on the county's technical work, ABAG reports, and the personal knowledge of the participants.

Goal

It is the goal of the Contra Costa County Surface Runoff Management Plan to define an implementable process to mitigate pollution problems in the receiving waters of the region which are caused by urban surface runoff.

Objectives

1. To define a continuing planning process to reveal any adverse impacts of urban surface runoff on the receiving waters of the region.

2. To more precisely define regional waters and the interior waters of the county.

3. To protect the natural ecology of streams and other county waters.

4. To protect the quality of surface waters used in the county for agriculture, industry, and domestic purposes.

5. To provide for public participation and public education in the continuing planning process.

6. To assess control measures according to their effectiveness in mitigating pollution problems in the receiving waters.

7. To evaluate control measures according to the principle of best management practices.

8. To evaluate control measures according to their cost effectiveness and feasibility of implementation within the existing governmental structure.

The plan responds to these objectives, primarily in Section VI, Assessment and Recommendations for Control Measures, and Section VII, the Continuing Planning Process. The definition of receiving waters, Objective 2, is found in Section V.

II. CONTENTS AND ORGANIZATION OF THE PLAN

Section I provides a brief background on why a Surface Runoff Management Plan was prepared, the concepts upon which this plan is based, and the plan goal and objectives which were developed by the Public Participation Committee and Advisory Task Force.

Section III attempts to give an understanding of the different substances which are found in surface runoff and their sources. A map delineating watersheds used in the technical studies is included.

Section IV, Summary of Findings, gives a brief overview of the technical work. Details on the review of reports, water monitoring and water quality modeling are in the Technical Appendices, bound separately, which is available on request.

The technical work done by the County, as is true for the other counties, was designed to give a general idea of the annual amounts of certain substances which wash off the land to the offshore receiving waters--the Bays, rivers and Delta. The technical work was not designed to determine if or where beneficial uses of the offshore receiving waters are adversely affected by the substances in surface runoff.

Section V describes previous and current attempts to make the connection between surface runoff and pollution damages, including the Basin Plan, ABAG Work Program, the Special Studies reports, and communication with informed persons in the county. Based on these references, it is clear that surface runoff from the county has not been shown to cause fish kills or other adverse effects on the beneficial uses of the offshore receiving waters for the substances included in the monitoring and modeling programs. It appears, however, that harmful or potentially harmful substances are in surface runoff, particularly urban runoff, to an unknown extent which may be similar to national averages. There are also toxic chemicals in wide use today which are also believed to be present in surface runoff, but for which we have no data. Any of these may prove harmful to the offshore receiving waters or the interior waters of the county.

The recommended control measures and implementing authorities are given in Section VI. The majority of recommendations are taken from a list prepared by ABAG and are intended to incorporate water quality considerations into public plans, programs and projects more fully than in the past. In conformance with the EPA recommended approach, the recommended control measures are not new programs or projects, but are "best management practices" to incorporate a greater degree of water quality consideration in existing maintenance, cleaning and clearing programs, and land management practices in open space areas and on construction sites, and in plans and programs for local government activities in the future. Special emphasis is placed on erosion control on construction sites.

The Continuing Planning Process, Section VII, gives the local government coordination and action items considered the best approach for carrying out the plan.

III. SURFACE RUNOFF

A. WATERSHEDS IN THE COUNTY

The County was divided into thirteen major watersheds for this study of which ten were examined in detail. The upper Alameda Creek and San Leandro Creek basin lying in Contra Costa County were studies by Alameda County because most of those basins, and their outlets to the Bay, lie in Alameda County. The leveed Delta region was not modeled since its runoff--or pump out--characteristics do not lend themselves to this type of study. The ten watersheds used in the model, and the gaging stations where samples were taken for the water monitoring program, are shown on Map III-A.

The ten watersheds vary greatly in size and degree of urbanization. The general pattern of urbanization is major heavy industry located near the shorelines of the western and northern bay plains, with commercial and residential areas located landward along the narrow valley floors and lower hillsides, with open hills and steep ridges between each valley. Exception to this pattern are the Richmond highly urbanized area on the west coast and the Marsh and Kellogg agricultural areas on the east. The interior of the County has a very low rural population except for the Walnut Creek Basin which is ubanized all along its north-south axis. All watersheds except Richmond have 50 to over 90 percent open undeveloped land composed of steep hills vegetated in drought resistant shrubs. To the east grasslands and irrigated farmlands dominate the landscape. Although the county's population is somewhat over 500,000, communities are distributed so that many small creeks carry runoff from small to medium sized communities. The Walnut Creek watershed contains approximately half the county population distributed along its 20 mile length. All these communities are predominantly developed in single family detached housing at densities from 2 to 6 per acre. Densities in the hills bordering each valley are lower.

B. SOURCES AND CONSTITUENTS OF SURFACE RUNOFF

The primary source of surface runoff is precipitation. Lesser amounts come from garden or farm irrigation. Since most streams in the county are intermittent or have extremely low dry season flows, surface runoff is equated with storm runoff. As surface runoff flows across open land, roofs, lawns, streets, gutters and through storm drains, it picks up a wide variety of substances and carries them along to the receiving waters. From open space areas the primary constituents are soil and organic particles. The minerals suspended or dissolved in the water depends, like soil, on the minerals in the bedrock from which the soil was formed. Organic materials are derived from plant and animal life. From urban areas the constituents include soil and organic materials, plus a great variety of materials from man's activities, primarily from vehicles. Figure III-B gives a list of these with averages for concentrations of pollutants in various materials in or associated with vehicles. Other substances not on the list would also be found.

Additionally, there are paints, pesticides, plant and animal wastes, and soil particles in urban areas which find their way to receiving waters by means of surface runoff, and an unknown contribution from aerial fallout onto water

Map III-A MAC WATERSHEDS

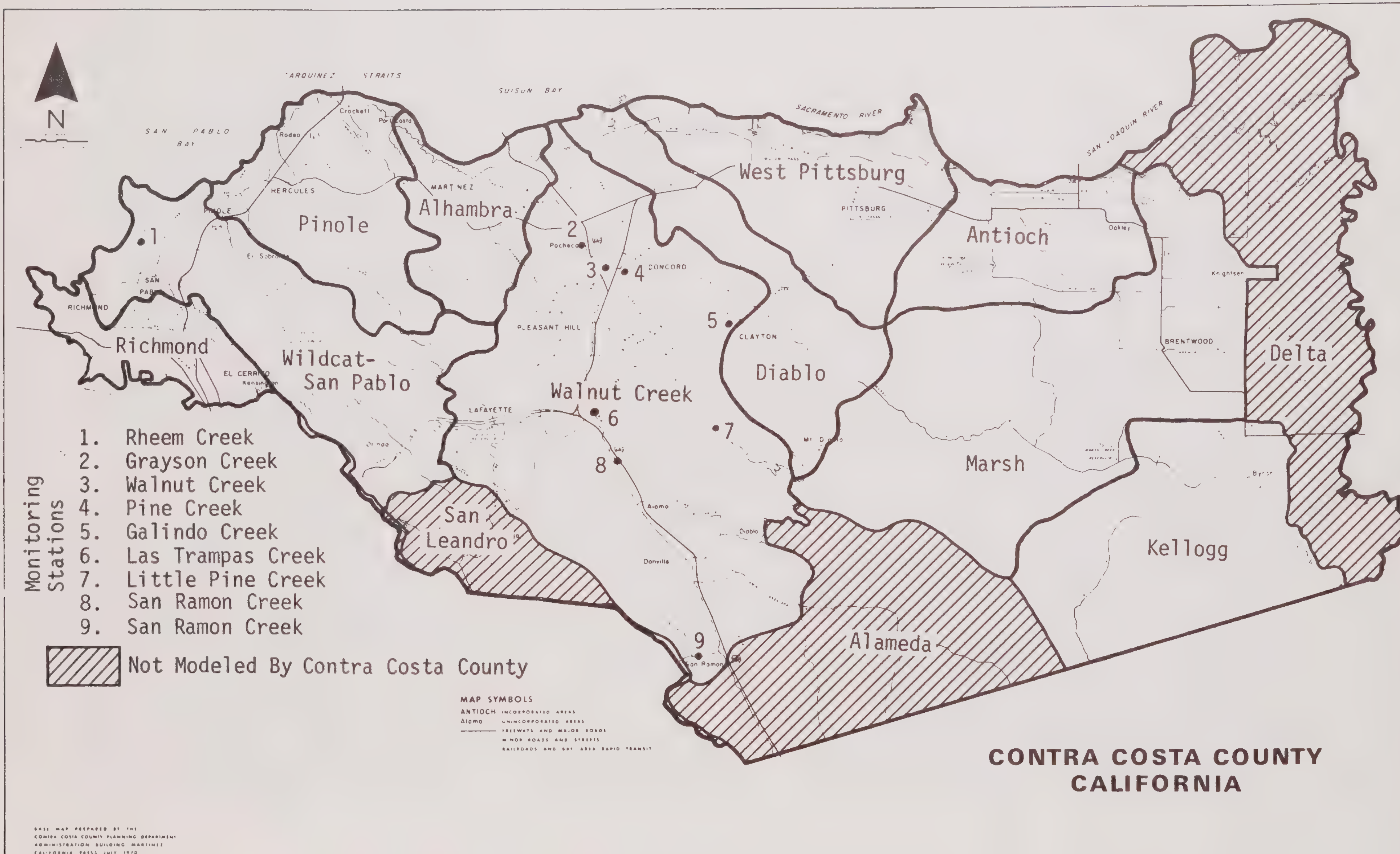


Figure III-B

Amounts of Pollutants Contained in Materials

Material	Tot. Vol. Solids mg/g	BOD[a] mg/g	COD mg/g	Grease mg/g	Petroleum mg/g	n-Paraffins mg/g
Gasoline	1000	150	680	1.3	1.3	1.3
Lubricating Grease	970	140		750	670	570
Motor Oil	1000	140	220	990	940	850
Transmission Fluid	1000	100	200	990	940	880
Antifreeze	990	38	1100	140	70	6.1
Undercoating	1000	90	310	960	180	120
Asphalt Pavement	64	1.2	86	21	15	9
Concrete	71	1.4	64	2.7	1.3	1
Rubber	990	27	2000	190	100	56
Diesel Fuel	1000	80	400	390	310	210
Brake Linings	290	17	420	31	8.3	7.6
Brake Fluid	1000	26	2400	880	33	19
Cigarettes	860	85	780	30	21	2.7
Salt[b]	75	-		0	0.0	0.0
Cinders	0.0	-	59	1.3	1.2	1.2
	-	-		-	-	-

Material	Lead	Mercury	Metals Content (ug/g) Chromium	Copper	Nickel	Zinc
Gasoline	660	0.05	15	4	10	10
Lubricating Grease	2	0.05	2	1	1	160
Motor Oil	9	0.05	2	3	17	1100
Transmission Fluid	8	0.05	2	1	21	240
Antifreeze	6	0.05	2	76	16	14
Undercoating	120	0.05	2	1	480	110
Asphalt Pavement	100	0.05	360	50	1200	160
Concrete	450	0.05	93	99	260	420
Rubber	1100	0.05	180	250	170	620
Diesel Fuel	12	0.05	15	8	8	12
Brake Linings	1100	0.05	2200	31,000	7500	120
Brake Fluid	7	0.05	19	5	31	15
Cigarettes	490	0.05	71	720	190	560
Salt	2	0.05	2	2	9	1
Cinders	2	0.05	2	3	4	7
Area Soil	2	0.05	36	23	25	27
Detection Limit	2	0.05	2	1	1	0.01

* Shaheen, 1975, "Contribution of Urban Usage", EPA 60012-75-004.

[a] BOD determinations were made on "pure" materials using a seed of unacclimated age organisms.

[b] Results are on a dry weight basis. Salt as received contained 3.7% water, assayed 93.2% sodium chloride, and contained less than 0.005% cyanide.

directly and onto land surfaces. Industrial areas contribute a great variety of materials to air, water and land, in varying quantities depending on the permitted emissions and discharges. Air quality and water quality treatment is required of industry. For this county, and for most of the Bay Area except the southern part of San Francisco Bay below the Dumbarton Bridge, Delta outflows contribute significantly to fresh water, suspended solids and nutrients. This is discussed further in Section IV-D.

The constituents in rainfall itself may include nutrients and pollutants such as nitrogen, industrial chemicals, heavy metals, pesticides and various forms of chlorinated hydrocarbons. The small amount of rainwater quality data for the region prevents a valid assessment of the contribution of rainfall itself. Since heavy metals and some other substances have a strong affinity for clay particles, substances in rainfall that are mixed with suspended solids in surface runoff have the advantage of becoming adsorbed onto soil particles before reaching the receiving waters. The large suspended solids load from Delta outflow, as well as from the land around the Bays, tends to attract pollutants and carry them to the bottom. For this reason suspended solids, at least the fraction that is composed of fine clay particles, is considered beneficial to the offshore receiving waters.

Suspended solids from open space and urban areas which reach impounded waters can impair beneficial uses by silting in the bottom and thus reducing the water holding capacity. Surface runoff may also add nutrients to a level that requires a management program for algae control. Or, in the case of a municipal water supply reservoir, cause tubidity which requires costly treatment. Urban street runoff, septic systems, and concentrations of livestock add to nutrient and bacterial loads. Street runoff also contributes the substances listed in Figure III-B. It is axiomatic that all dams silt up. Sediments themselves are often considered a maintenance problem.

IV. SUMMARY OF FINDINGS

The findings come from several sources, including the monitoring and modeling programs undertaken by the County. None of the sources have revealed beneficial uses of off shore receiving waters which are impaired by surface runoff. Further monitoring at locations selected for their relevance to potential "hot spot" pollution is recommended. The controls recommended for short term implementation are aimed at mitigating widespread but non-critical conditions observed by local staff in the field. It is recognized that these good housekeeping and land management measures may have only marginal benefits to the offshore receiving waters, but they are expected to benefit the interior waters of the county.

A. REVIEW OF REPORTS

1. General Reports and Studies

A large number of reports and studies were reviewed. None were able to give a picture of water quality in the interior waters of the county, since this has not historically been a matter of as great interest as flood control and drainage needs. A bibliography is given in the Technical Appendices, bound separately. Verbal communication with reservoir owners indicate a few impounded water bodies which have their beneficial uses or potential beneficial uses impaired by water quality problems. These are discussed in Section V.

2. Special Studies

ABAG consultants presented reports on:

- Delta outflow
- Shellfish contamination
- Eutrophication (in the Bays)
- Effects of toxicants (including heavy metals)
- Fish kills
- Dredging and dredging spoils disposal

"The purpose of the special studies, therefore, is to approach the sequence (problem-cause-control) from the problem point of view and ensure that adequate attention is given to the more critical problems." (ABAG Work Program, p. 323.) All of the final special studies reports were not available in time for data pertaining to the interests of the County to be incorporated into this draft. The brief summary reports available for each special study indicate that no regional problem in the offshore waters is known to exist. However, there are known or suspected localized "hot spots" where excessive amounts of toxic materials, heavy metals, and bacterial contamination of shellfish occur.

B. THE WATER MONITORING PROGRAM

The purpose of the monitoring program was to determine the contents and concentrations of possible pollutants in the county's surface runoff, compare

these with national averages, and develop concentration factors for use in the watershed modeling program.

Monitoring was performed primarily at existing stream gage stations. The locations of the stream gage stations used are shown on Map III-A. All monitoring stations were located in the Walnut Creek Watershed with one exception--a station on Rheem Creek in the Wildcat-San Pablo watershed.

Monitoring results for Biochemical Oxygen Demand (BOD), Total Nitrogen (TN) and Total Phosphorus (TP), are comparable to results from previous years of more normal rainfall in an Alameda County watershed. As a result, the concentrations measured for these constituents appear to be valid for normal runoff conditions in developed areas. Open space values would probably be higher by 50 percent to 200 percent than samples taken in this drought season of 1976-1977.

The measurement of volatile and suspended solids appears to have been affected by the drought. Concentrations of suspended solids is related to storm intensity. The concentrations presented in Figure IV-B-1 are therefore representative only of this year's drought conditions.

A few water samples collected at random were analyzed for Total Coliform Bacteria, Fecal Coliform Bacteria, Cadmium, Chromium, Mercury, Zinc, and Copper. Only four out of fourteen samples met the state coliform standard for non-contact recreation (an average of 2000/100 millimeter for any 30 day period). The results from the measurement of heavy metals are not conclusive regarding their potential for adverse effects on beneficial uses. Recent scientific thinking postulates that heavy metal absorbed onto fine particles of suspended solids do not harm aquatic life, but that it is heavy metals floating freely in water which are harmful. Water column tests which would provide information on concentrations of heavy metals in the water itself are difficult to perform, subject to error, and costly. Further analysis of heavy metals was considered but not performed due to unresolved questions concerning the effects of heavy metals, the abnormally low amount of rainfall during the past year and the uncertain results of the tests required to determine heavy metals concentrations.

The results of this first effort are not conclusive because of subnormal runoff experienced and by the limited extent of the monitoring program. Concerns which still remain to be resolved include:

1. Long-term average concentrations of potential pollutants

2. Background levels of constituents which occur naturally, including substances, rainfall and aerial fallout.

3. Whether or not un-monitored watersheds are comparable to the Walnut Creek watershed.

4. Seasonal and storm frequency differences in concentrations. (Is the third storm as "dirty" as the first storm?)

Figure IV-B-1
Concentrations of Constituents in Water Quality Samples
1976-1977 Season

Monitoring Station	Flow (cfs)	BOD (mg/l)	SS (mg/l)	VSS (mg/l)	TDS (mg/l)	Total P (mg/l)	Total N (mg/l)	Lead (mg/l)
Grayson @ Center		11	83	18	680	0.27	2.07	
Los Trampas @ Main		6	230	36	180	.50	2.75	.17
San Ramon @ Walnut Creek	76	10	170	25	550	.57	2.70	.08
	79	7	76	12	570	.26	2.05	.07
	48	7	150	22	570	.46	2.22	.05
Walnut Creek @ Diamond	34	6	76	33	520	.31	4.57	.05
	145	11	190	26	2,500	.56	3.0	.18
	160	11	140	24	310	.56	2.70	.15
	139	7	120	19	320	1.50	2.28	.08
	170	10	140	26	350	.49	2.73	
	187	4	250	21	240	.42	2.82	
	39	13	6	3	600	.22	0.96	
Pine Creek @ Market		18	150	27	400	.40	7.32	.31
		14	220	39	260	.56	4.40	.26
		10	300	37	220	.54	3.60	.01
		10	310	38	200	.48	3.10	.11
		15	450	67	190	.63	3.72	.52
		13	710	88	250	1.90	4.84	.33
		11	500	59	2,300	.48	4.76	.25
		14	100	20	620	.18	2.45	
		12	230	36	230	.42	1.62	
		14	140	5	250	.44	1.68	
		19	10	2	800	.02	3.01	
Little Pine		10	5,200	550	380	2.40	16.20	
Galindo		16	32	2	910	.08	6.50	
San Ramon @ San Ramon	1.2	6	120	24	580	.64	2.66	.07
	3.5	8	300	50	440	.69	3.11	.03
	1.4	4	110	22	430	.38	2.13	.02
Rheem @ Gage	--	13	73	16	2,000	1.20	5.38	.35
	01	40	130	32	3,400	3.9	4.78	.45
	35	23	280	32	3,300	.68	5.20	.45
	29	18	130	22	190	.46	3.65	.24

5. The actual extent and level of bacteria in surface runoff--and its primary sources.

6. Possible local areas in the county from which unusually high concentrations of harmful substances reach the receiving waters (Hot Spots).

7. The existence of potential pollutants which were not studied, including toxic chemicals and metals.

8. Concentrations of toxicants, including heavy metals, in the water column as opposed to being attached to sediment particles, and in toxic versus non-toxic forms.

Conclusion: The monitoring program provided the basis for factors for the mathematical modeling program which are probably satisfactory given the gross nature of the model, but further monitoring at appropriate locations, and testing for materials of concern in the community, would be required to confirm or modify the results of the 1976-77 program. If the monitoring results are valid, surface runoff from the county is lower than secondary treated sewage effluents in concentrations of Biochemical Oxygen Demand, Total Nitrogen and Total Phosphorus. Suspended Solids and Volatile Solids concentrations are far greater from surface runoff than from sewage effluent, as would be expected.

C. THE WATERSHED MODELING PROGRAM

The purpose of the watershed modeling program was to estimate annual pollutant loading to the bays from eight bay area counties under present development conditions (actually 1975) and for the years 1985 and 2000, in order to be able to determine if there may be future pollution problems in the offshore receiving waters.

The model used in the modeling program was the Macroscopic Planning Model (MAC). This model is designed to estimate total pollutant loadings from large areas based on annual average rainfall. The model is based on the simple concept that the pollutant loading from any area equals the product of the surface runoff from that area times the concentration of the pollutant in the runoff. The MAC model was run on ten watersheds in the county (Map III-A) for the years 1975, 1985 and 2000 assuming an average annual precipitation. Land use assumptions for these years are based on the Provisional Series 3 Projections, Base Case 1 to 1985 with an alternative to the year 2000. Monitoring results from the eight counties participating in this planning program were used to derive factors for use in the model. These baseline factors were modified by each county depending on its local conditions and circumstances. The factors used in this county are given in Figure IV-C-1. National averages are also given for comparison. Reasonable confidence is placed in the factors used for residential, commercial and industrial land uses. Drought year erosion rates are not reliable for determining SS factors in an average rainfall year. The SS factor used does not have the degree of reliability of the other factors.

Figure IV-C-1

Concentration Factors by Land Use

Land Use	Pollutant Concentration (mg/l) BOD	SS	VSS	Tot P	Tot N
Residential*					
National Av.	10.40	211.5	123.00	0.44	7.01
Local (use by County)	15.00	250.0	62.00	0.40	3.50
Commercial					
National Av.	41.50	288.1	181.70	0.98	3.84
Local	20.00	150.0	70.00	0.70	5.00
Industrial					
National Av.	15.80	377.6	186.80	0.91	3.58
Local	13.00	120.0	50.00	0.50	3.00
Open Space					
National Av.	0.21	499	4.79	0.02	0.11
Local	4.00	800**	30.00	0.30	2.00

*Base values were modified according to local population density
**Base values were modified based on analysis of prior investigations.

The results of the MAC model for Contra Costa County are presented in Figure IV-C-2. The results describe conditions for ten watersheds in the county and the average annual loads for 1975, 1985 and 2000 levels of development, for the constituents modeled.

Due to the Series 3 model outputs for population growth and development, the total area devoted to residential use in the county is assumed to increase by over 50% from 1975 to 1985 and would more than double by the year 2000. The land use and population projections were produced by ABAG's regional model and do not agree with County projections, which are for slower growth. These projections are approximately 8 percent higher than County projections for the period 1975 to 1985, on a countywide basis. Consequently, the watershed modeling results are based on a significantly greater degree of urbanization than is anticipated to occur.

The results of the modeling program are graphically displayed by region in the county and for the entire county in Figure IV-C-3. According to Figure IV-C-3 graphs for these regions in the county, all regions are projected to gain in population and residential land use. Projected changes in commercial and industrial land uses are expected to increase very slightly. The greatest increase in residential use is projected to occur between 1975 and 1985, with somewhat less open space conversion to residences from 1985 to 2000. Page 4, Total County, indicates a rise in BOD, Total N and Total P which is more or less equated to increased development. Suspended Solids show a reduction since open space generates a higher erosion rate than developed areas. This does, however, ignore the higher erosion rates experienced during construction activities.

From the modeling program it is evident that no extreme change in the loadings to the offshore receiving waters is projected to occur in the future.

D. SUMMARY AND COMPARISON OF FINDINGS

1. Comparison of Findings

The comparison of point source discharges (sewage treatment plant and direct industrial discharges) with surface runoff loadings as modeled, reveal the benefits of upgrading point source discharges to Federal standards, for BOD and SS. Reductions in the nutrient loadings of nitrogen (TN) and phosphorus (TP) will occur by 1985 after Federal point source limits are fully in force, but the point source loadings will remain large in comparison with surface runoff loadings. For suspended solids (SS), surface runoff is much higher than point sources, there being less dirt in sewage and industrial discharges. Solids themselves do not cause pollution in the offshore receiving waters, but they carry other substances which may cause adverse impacts on beneficial uses in certain quantities or forms. These substances were not modeled.

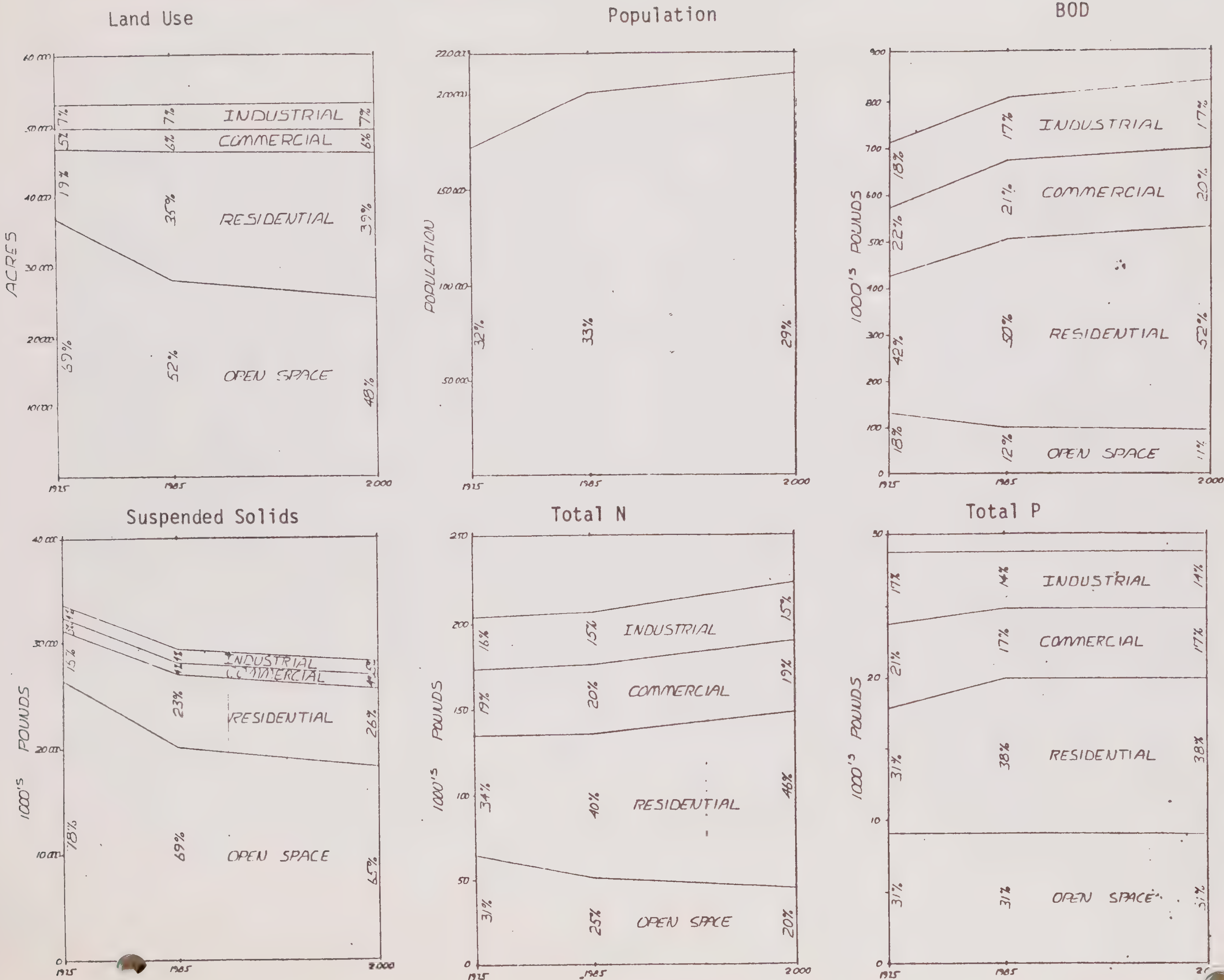
Because of the enormous Delta outflow which strongly affects all the offshore receiving waters of the region, a comparison was made among county surface runoff, point sources, and Delta outflows (Figure IV-D-2). Point source and Delta outflow data is from ABAG. The Delta outflow data is preliminary data from ABAG consultants.

Figure IV-C-2

RESULTS OF MAC MODEL FOR TEN WATERSHEDS IN CONTRA COSTA COUNTY

WATERSHED	AREA IN ACRES	AREA OF COUNTY	ANNUAL POLLUTANT LOADS (1000's of pounds) 1975 DEVELOPMENT					ANNUAL POLLUTANT LOADS (1000's of pounds) 1985 DEVELOPMENT					ANNUAL POLLUTANT LOADS (1000's of pounds) 2000 DEVELOPMENT				
			BOD	SS	VS	Tot P	Tot N	BOD	SS	VS	Tot P	Tot N	BOD	SS	VS	Tot P	Tot N
1. Marsh	70847	East	126	22966	901	9	60	125	22918	901	9	60	147	22537	975	9	63
2. Kellogg	41059	East	77	15350	578	6	39	78	15347	578	6	39	79	15314	582	6	39
12. Antioch	19197	East	101	6761	500	5	31	109	6387	526	5	33	153	5566	671	6	41
3. Walnut	91117	Central	877	50390	4204	36	263	1001	45463	4582	37	282	1079	42343	4819	39	295
4. Diablo	26989	Central	103	14821	662	7	44	106	14415	669	7	44	128	13637	739	7	47
5. Alhambra	15561	Central	112	7554	552	6	34	126	6874	597	6	37	144	6624	656	6	40
13. W. Pittsburg	23927	Central	143	9241	693	6	45	151	8980	721	6	46	179	8470	813	7	51
6. San Pablo	38938	West	219	10340	1008	9	63	257	8916	1126	9	68	270	8393	1165	9	70
9. Pinole	24357	West	144	16179	837	8	54	194	13776	983	8	62	206	13160	1023	8	63
16. Richmond	12339	West	350	7048	1418	12	87	358	6798	1442	12	88	369	6690	1482	12	91
TOTAL	364,331		2252	160,650	11353	104	720	2505	149,874	12125	105	759	2754	142,736	12925	109	800

MAC[illegible] TERSHED CHARACTERISTICS - WESTERN COUNTY



RESULTS OF MAC MODEL BY REGION AND FOR THE TOTAL COUNTY

Figure IV-C-3
Page 1

MA ERSHED CHARACTERISTICS - CENTRAL COUNTY

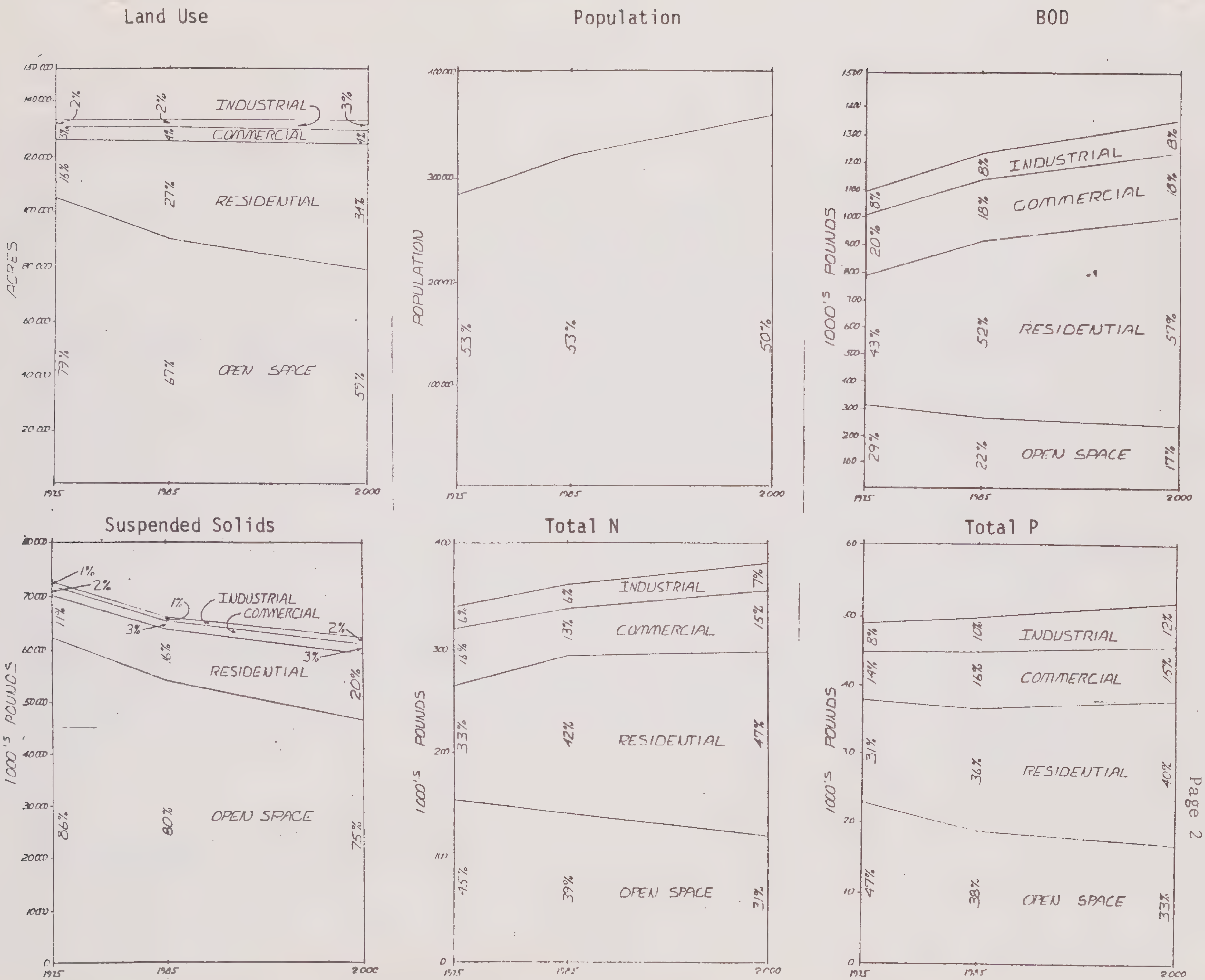


Figure IV-C-3
Page 2

MAG WATERSHED CHARACTERISTICS - EASTERN COUNTY

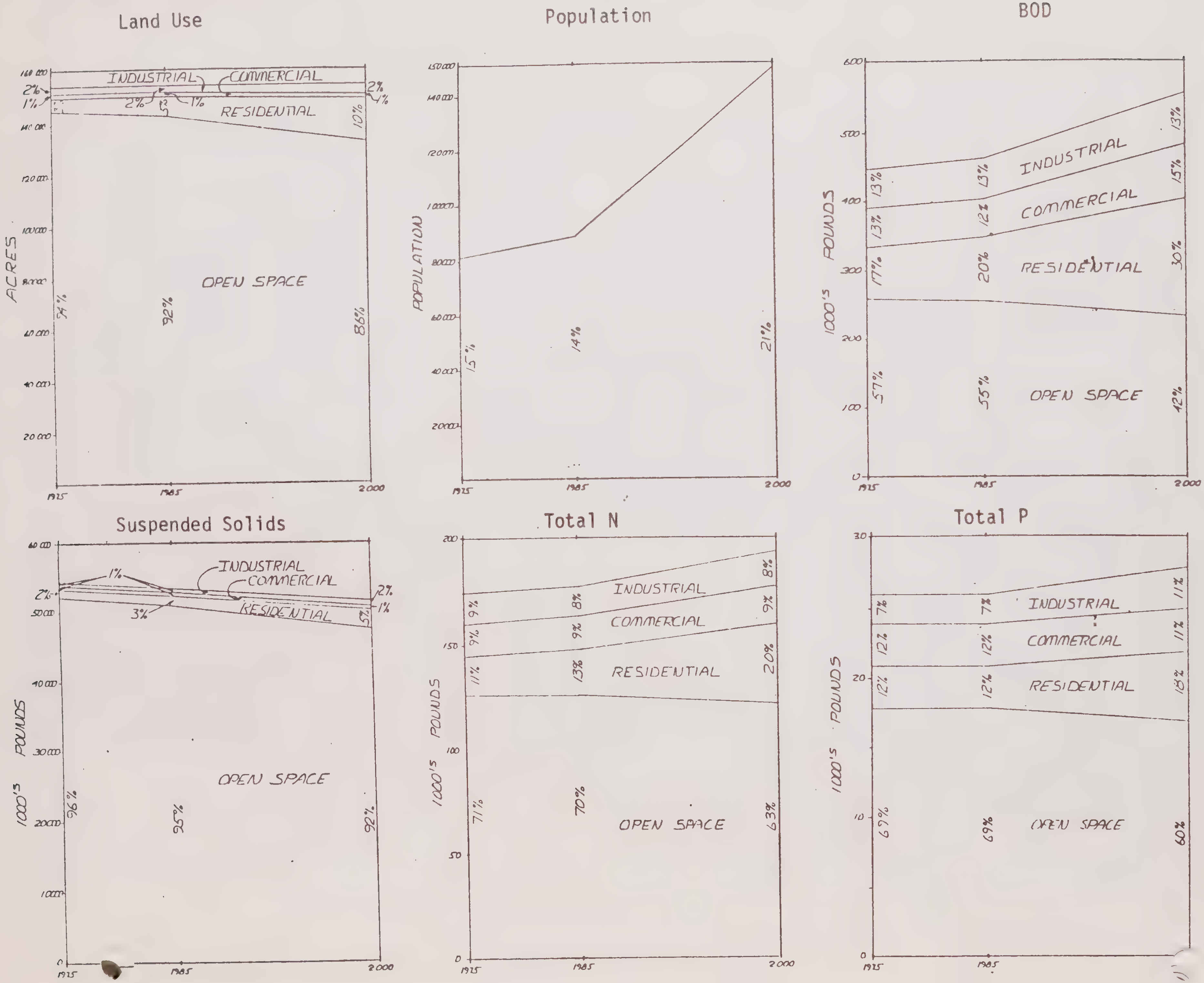


Figure IV-C-3
Page 3

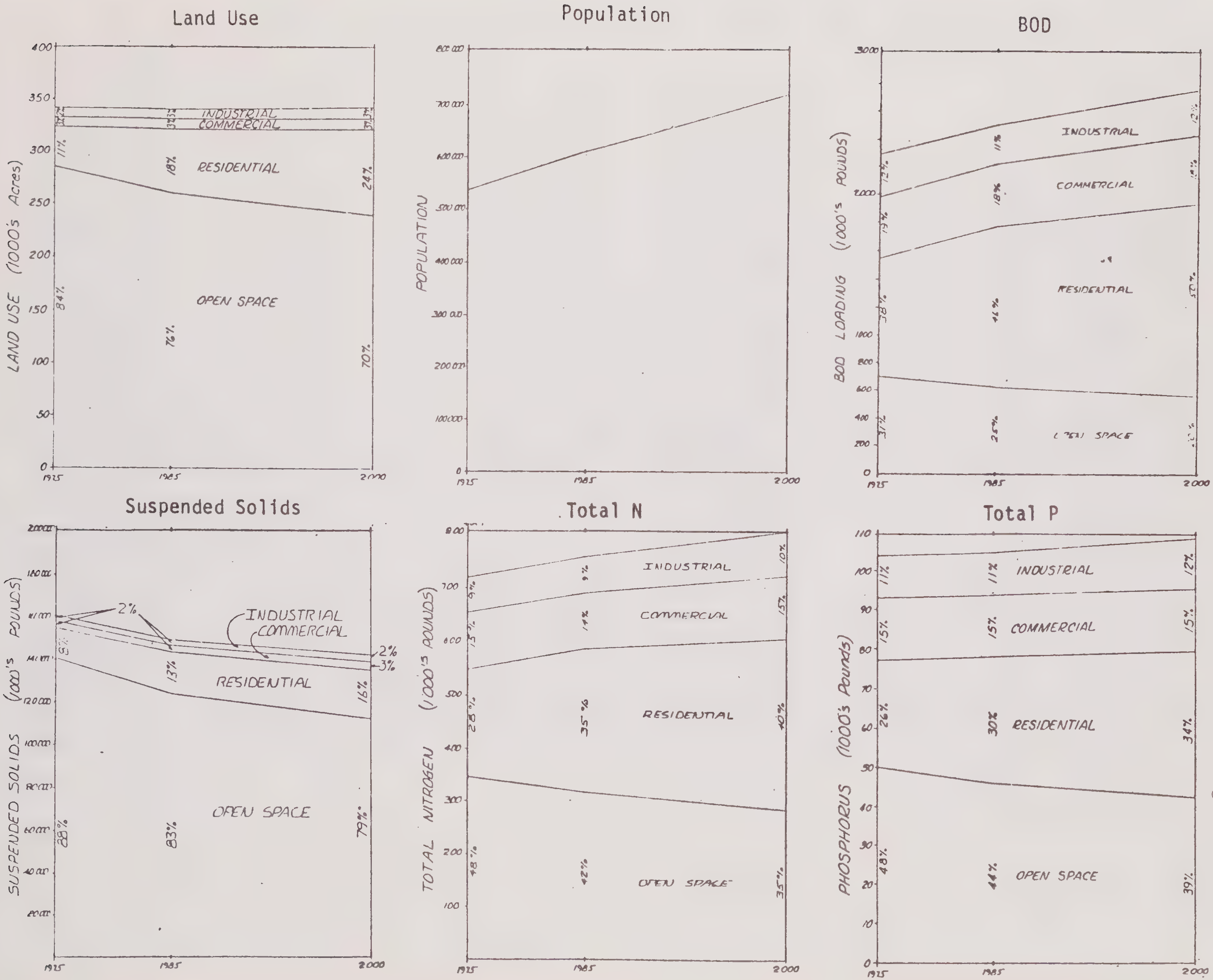


Figure IV-C-3
Page 4

From Figure IV-D-2 it can be seen that total county loadings, including point sources and surface runoff, are marginal in comparison with Delta outflow loadings, except for BOD in 1975. By 1985, however, county BOD loadings will have been reduced to approximately 10 percent of Delta outflow loadings, on an annual basis, due to improvements in point source discharges, primarily the 201-funded wastewater treatment plants.

If all of the loadings shown were completely eliminated from surface runoff, but Delta outflows remained the same, the total loadings reaching the bays in 1985 would be reduced by:

5% for BOD
5% for SS
1% for TN
0.4% for TP

2. Conclusions

a. The results of the Macroscopic Planning Model give only a general indication of future conditions. The model is unsophisticated, there are uncertainties associated with the water quality data used in the model, and the assumptions made concerning population growth and expansion of residential development in Contra Costa County are erroneous. For these reasons, cautious and careful application of model estimations in determining the extent of future water quality problems is indicated.

b. Neither the monitoring or modeling programs indicate that surface runoff from this county, for the substances considered, are causing harm to beneficial uses of the Bays and rivers.

c. Comparison of surface runoff and point source discharges indicates the relative benefits which can be achieved by improvements in point source discharges.

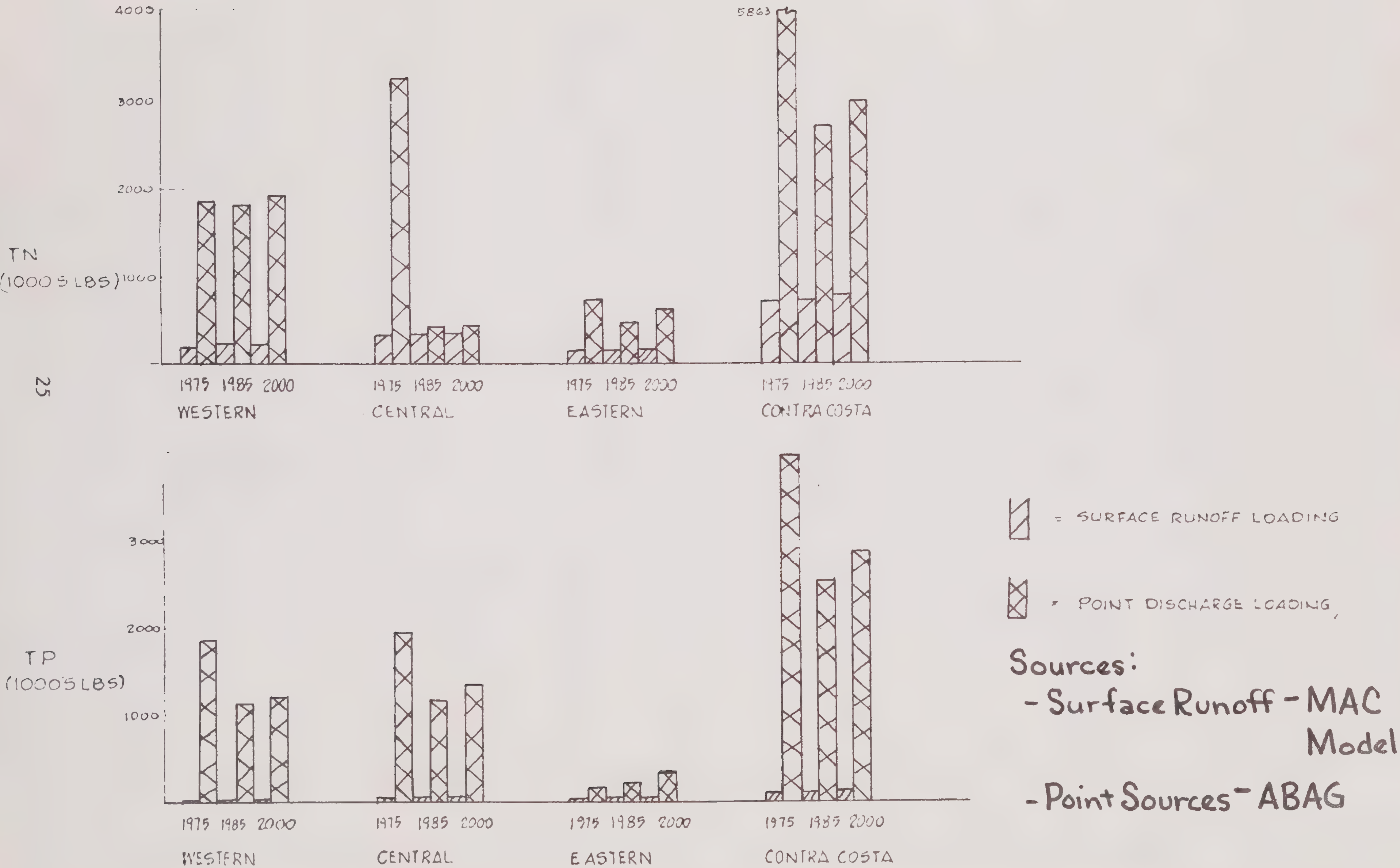
d. Comparison of county loadings and Delta outflows indicates the relatively minor contribution of surface runoff to the offshore receiving waters.

e. A fundamental question which has yet to be answered is what constituents of surface runoff and Delta outflows are serious pollutants. Although the modeling program provides estimates of future loadings of the substances modeled, it does not describe the impacts of these loading on the beneficial uses of the offshore receiving waters. Effects may be beneficial for the substances involved.

f. The watershed modeling program did not include pesticides, toxic forms of heavy metals, and exotic chemicals which may cause the greatest long-term damages to water quality, aquatic life and perhaps man. Contra Costa County may or may not contribute substantially to the discharge of these substances to the bays. These substances are of growing interest among the citizenry and should be investigated.

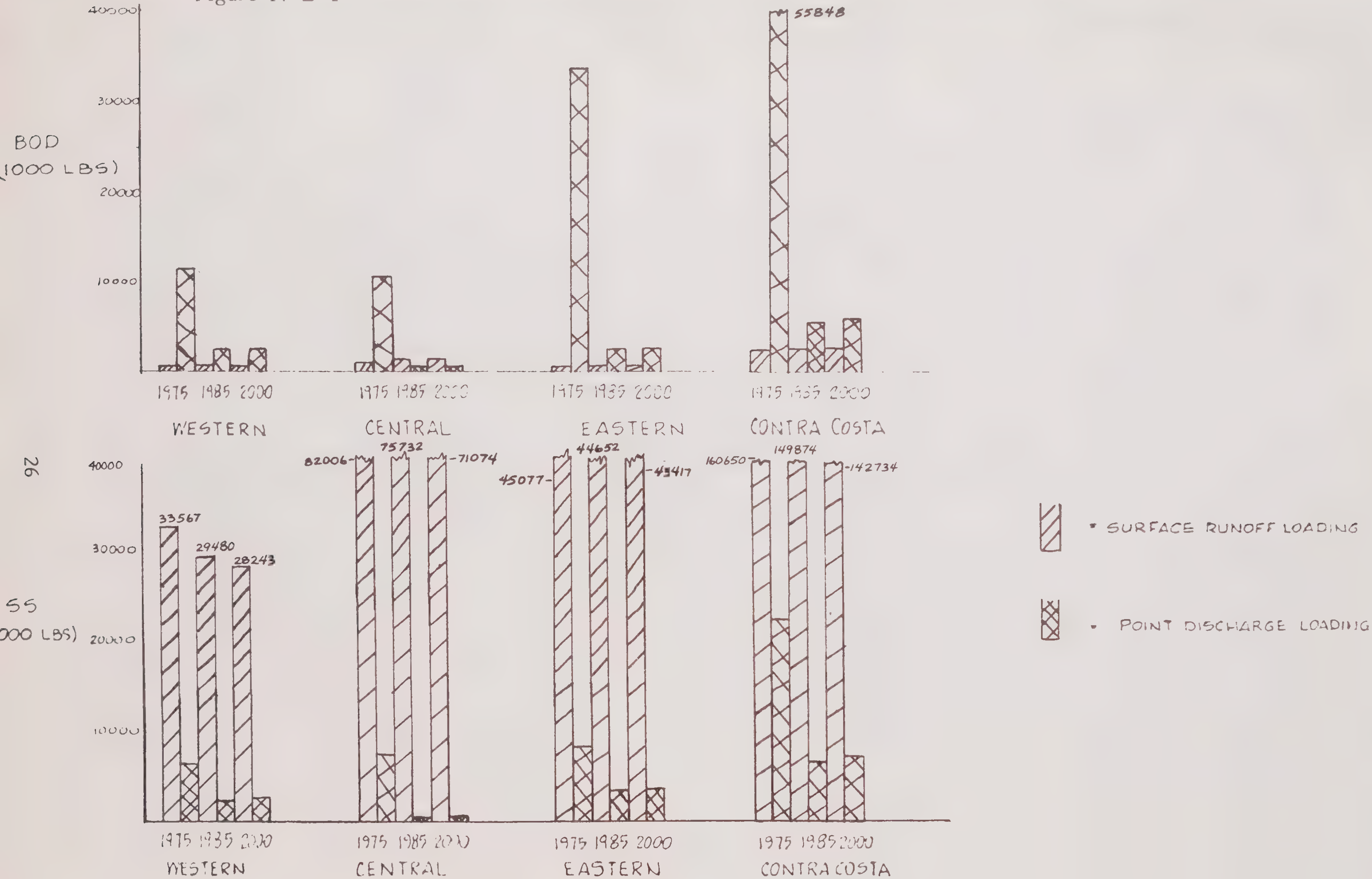
Contra Costa County Surface Runoff and Point Source Discharges

Figure IV-D-1



Contra Costa County Surface Runoff and Point Source Discharges

Figure IV-D-1



Sources: Surface Runoff - MAC Model
Point Sources - ABAG

Figure IV-D-2

Comparison of Contra Costa County Loading:
Surface Runoff, Point Sources, and Delta Outflows
1975 and 1985

Year	Constituent*	Source	Thousands of Pounds/Year	Total County and Delta Thousands of Pounds/Year	
1975	BOD	Surface Runoff	2,250	County	57,550
		Point Sources	55,250		
		Delta Outflow**	44,000	Delta	44,000
	S.S.	Surface Runoff	160,650	County	182,800
		Point Sources	22,150		
		Delta Outflow	3,000,000	Delta	3,000,000
	T.N.	Surface Runoff	700	County	6,550
		Point Sources	5,850		
		Delta Outflow	129,000	Delta	129,000
	T.P.	Surface Runoff	100	County	4,050
		Point Sources	3,950		
		Delta Outflow	22,000	Delta	22,000
1985	BOD	Surface Runoff	2,260	County	8,100
		Point Sources	5,600		
		Delta Outflow	44,000	Delta	44,000
	S.S.	Surface Runoff	149,850	County	156,450
		Point Sources	5,660		
		Delta Outflow	3,000,000	Delta	3,000,000
	T.N.	Surface Runoff	750	County	3,450
		Point Sources	2,700		
		Delta Outflow	129,000	Delta	129,000
	T.P.	Surface Runoff	100	County	2,600
		Point Sources	2,500		
		Delta Outflow	22,000	Delta	22,000

Sources: Surface Runoff from MAC Model. Point Sources and Delta Outflow from ABAG.

*BOD = Bio Chemical Oxygen Demand
SS = Suspended Solids
TN = Total Nitrogen
TP = Total Phosphorus

**Based on present Delta Outflow.

V. IDENTIFICATION OF RECEIVING WATERS AND WATER QUALITY PROBLEMS

Plan objective 2. is to define regional waters and the interior waters of the county. Concepts of regional waters are available from the Regional Water Quality Control Board (RWQCB) and ABAG. The RWQCB has adopted the 113 water bodies in the Bay Area, listed in the Basin Plan, as regional waters. Those all or partly within county boundaries are listed in Figure V-A. They include offshore Bays and rivers, the Delta, major open reservoirs, and three creeks. The regional Surface Runoff Management Plan accepts this definition. For purposes of discussing water quality problems in this plan, the county's position is that, though all the water bodies mentioned lie within the Bay Area region, only the Bays, rivers and Delta sloughs are regional waters as such. The plan refers to these as the offshore receiving waters. Impounded and free flowing waters in the county--its interior waters--are local water bodies. It is recognized that substances and conditions may affect both the interior and offshore receiving waters.

Subsection A discusses water bodies identified in the Basin Plan. Subsections B and C discuss possible pollution problems given by ABAG in the 208 Work Program and in other 208 materials. Section D discusses potential problems derived from communications with persons in the county, and by the SRMP technical work. Some items are not related to the County work on surface runoff, but are included here because they all were on the same list.

A. BASIN PLAN

Figure V-A lists the waters in and near the county listed in the Basin Plan, the potential beneficial uses listed in the Basin Plan, and attempts to determine whether or not these potential uses are prevented or impaired by water pollution. For the offshore receiving waters, the Basin Plan does not identify beneficial uses as impaired by pollution. For the interior waters of the county high bacteria levels in the creeks may be above standards for recreation. However, there are other reasons why recreation is only a "potential" use. These reasons are given in the Figure.

B. 208 WORK PROGRAM

In addition to the receiving waters identified in the Basin Plan, the ABAG Work Program has identified site specific problems to be addressed by Contra Costa County, plus related regional problems. These are listed below with comments.

1. Sediments high in toxic metals in San Pablo Bay off Pinole.

   No monitoring took place on Pinole Creek because of inadequate funds. Sediments were not sampled by the counties. The MAC model is not designed to reveal any unusual or exceptional circumstances. Recent scientific thinking, as reported by ABAG's 208 consultants, indicates that heavy metals in sediments may not have adverse effects. Toxic forms of heavy metals in the water itself, not adhering to soil particles, is the

Figure V-A

WATER BODIES IN AND NEAR CONTRA COSTA COUNTY
FOR WHICH THE BASIN PLAN SHOWS POTENTIAL BENEFICIAL USES

Water Body	Potential Beneficial Use	Use Impaired By Pollution?	Comments
Briones Reservoir (E.B.M.U.D.)	Non-Contact Recreation Contact Recreation Cold Water Habitat	No No No	Owners do not choose to have recreation.
Pinole Creek	Non-Contact Recreation Contact Recreation	?	Public and private ownership restricts access. No recreation authority. Bacterial levels may be high. Winter flows may be hazardous.
Walnut Creek	Non-Contact Recreation Contact Recreation	?	Public and private ownership restricts access. No recreation authority. Bacterial levels may be high. Winter flows may be hazardous.
Mallard Reservoir (C.C.C.W.D.)	Non-Contact Recreation	No	Owners do not choose to have recreation. No surface runoff into this reservoir.
Marsh Creek	Non-Contact Recreation Contact Recreation	?	Private and public ownership restricts access. No recreation authority. Bacterial levels may be high. Winter flows may be hazardous.
Marsh Creek Reservoir (Flood Control)	Non-Contact Recreation Contact Recreation	No	No recreation authority. Possible bacterial contamination--but no indications of this at present.
Central Bay San Pablo Bay Suisun & Lower San Joaquin Delta	Preservation of Areas of Special Biological Significance	No	Not presently designated by State Water Resources Control Board as requiring protection of biological species or communities to the extent that alteration of natural water quality does not occur.

Note: Other water bodies in or near Contra Costa County for which the Basin Plan shows existing beneficiai uses, but no potential uses, are: San Pablo Reservoir, Contra Loma Reservoir and Lafayette Reservoir. Figure V-A lists only potential beneficial uses, not existing beneficial uses.

heavy metals "culprit" regarding damages to aquatic communities. Nevertheless, if there are unusually high concentrations, or "hot spots" here, it is deserving of further investigation.

2. Shellfish harvesting in the Bay off Richmond is prohibited due to high levels of bacterial and/or heavy metal contamination.

   The Brooks Island clam beds are open to recreational taking as a result of closing the Stege sewage treatment plant, except for occasional high storm runoff periods, several years ago. It is advised that the clams be thoroughly cooked, an indication of potentially less than ideal bacterial concentrations. Commercial harvesting is prohibited by the state due to bacteria, much of which is reported to be derived from surface runoff.

3. Significant annual fish kills in Carquinez Straits.

   These characteristically occur during summer, so are not due to "shock loading" from storm runoff. According to ABAG Special Studies consultants and the State Department of Fish and Game, the nature and location of the causes are not known. Losses may amount to thousands of striped bass annually, and could eventually add sufficient pressures to the bass population to reduce recreational fishing opportunities, unless it is part of normal annual fish deaths.

4. Degree of future treatment in Western Delta uncertain.

   Sewage treatment in the Western Delta, and eastern county, will be resolved when the subregional sewage treatment facilities are constructed. The Discovery Bay wastewater discharges meet state standards.

5. Periodic algae blooms due to high nutrient concentration in Suisun Bay and Western Delta.

   These algae blooms usually occur during summer and fall, not during storm runoff periods. The suspended sediments brought in each year by Delta outflows, and resuspended by wind action, are believed to be effective in preventing algae blooms from being more frequent and severe. "High" nutrient concentrations are normal in the regional waters.

C. OTHER RELATED REGIONAL PROBLEMS (from ABAG)

1. Insufficient guidance and control measures for location, use, approval, maintenance, and alternatives for septic tanks.

   This comes under Miscellaneous Sources.

2. Deficiency of regulations for control of construction related activities which impair beneficial uses.

   Sufficient regulations have been adopted by cities and the counties. Additional enforcement would help to reduce construction related erosion. A creek setback ordinance would facilitate bank erosion repairs and is included in the Recommended Control Measures.

3. Insufficient data and impact assessment of non-urban runoff.

   Recommendations for further study and for land management practices are part of the SRMP. Land management practices are included in the Recommended Control Measures.

4. Absence of facilities to accommodate vessel wastes from private, commercial, and military water craft.

   This is included in Miscellaneous Sources Plan. Probably contributes to localized high bacteria counts in some areas, possibly affecting nearby shellfish beds.

5. Insufficiency of current planning to determine the interrelation of water quality control facilities to future growth patterns and potential service areas.

   This is found in the Wastewater Management Plan, but is not a correct statement for this county.

Summary: Insufficient knowledge exists regarding the impacts of surface runoff on beneficial uses of the offshore receiving waters, represented by the five items from the ABAG Work Program Subsection B above. Item 3 in Other Related Regional Problems Subsection C, is correct regarding the scope of the SRMP. Literature research, mathematical models and monitoring the interior waters of the county for nutrients can add little, if anything, to needed knowledge. Basic field research by competent scientists is very much needed to reveal the causes of damages to aquatic life in the Bays, rivers, and Delta.

D. LOCAL WATER QUALITY PROBLEMS IN THE COUNTY

The items above from the Basin Plan include concerns with regional and local waters. The items from the ABAG Work Program, Subsection B, focus on potential pollution problems in the regional waters. Items from ABAG in Subsection C identify potential regional water quality problems related to surface runoff and other sources. Item 2 regarding regulation of construction related activities is most relevant to the investigation made in the county to disclose local water quality problems in the interior waters of the county. Discussion with County and city staff, the water districts, and others, plus general observations, reveal the following water quality problems affecting the interior waters of the county:

1. San Pablo Creek in Orinda, above the San Pablo Reservoir, has historically had high levels of coliform bacteria. The traditional chlorination treatment may have an adverse effect on fish spawning. The creek is under study to determine the best way to manage this problem.

2. San Pablo Reservoir has experienced an increase in estimated siltation from 50,000 cubic yards a year to 170,000 cubic yards a year, attributed to construction projects in the upper watershed. This reduces reservoir capacity and adds to the cost of treatment to remove turbidity.

3. Surface drainage into the Contra Costa Canal, a conveyance facility of the Contra Costa County Water District.

4. Open space, construction sites, and stream banks themselves contribute to sediment transport and deposition. These conditions, partly natural and partly from man's activities, occur throughout the county. Some sediments are transported into the offshore receiving waters and some are deposited in the lower reaches of the stream. Sediments reduce channel capacity to carry floor flows and cause maintenance costs when they must be dredged out of the creeks. Erosion itself damages land and creeks. It has been estimated (USGS) that as much as 65 percent of the sediments coming from the Walnut Creek watershed are deposited in the lower reaches of Walnut Creek.

5. Illegal dumping of litter, garbage, trash, oil and grease, along roads and into streams, improved channels, storm drains and gutters, is widespread. Public education, strict enforcement of penalties, and alternative disposal means are needed to mitigate this problem.

6. Accidental or intentional discharges of hazardous or toxic materials into creeks or storm drains. These occurrences are believed to be only occasional, but the effects can be extreme for a short period of time. The Department of Fish and Game reports two fish kill incidents on Pinole Creek in 1974-1975, and one fish kill from swimming pool chlorine on Las Trampas Creek in 1975.

7. Bacterial levels above standards for non-contact and contact recreation. Although not sufficiently substantiated, it is an educated guess partially confirmed by the monitoring program, that most streams in the county have coliform counts above standards most or all of the time, making them potentially unsafe for recreation. Sources include mammalian wildlife, cattle, horses, and other livestock, and pets. A subsurface contribution may be made by septic fields and leakage from sanitary sewers. Effects on the Bays are not known to be adverse, but high bacteria counts could spoil an opportunity to open a segment of a creek to recreation.

8. Water quality problems in Hidden Lakes in the City of Martinez have adverse impacts on recreational uses. Whether or not surface runoff is the primary cause has not been determined.

9. Additional communications with the East Bay Regional Park District regarding any existing or potential water quality problems in lakes and reservoirs used for recreation will be included in the Continuing Planning Process.

10. Although not strictly a part of the County's SRMP, residents are always mindful of Delta water quality. The proposed rock barriers to prevent further salinity intrusions may also make parts of the Delta behind the barriers stagnant. It will be interesting to find out how severe problems with bacteria, agricultural nutrients and algae blooms will be. Perhaps something can be learned from this regrettable emergency which will be useful in solving water quality problems in the Delta and Bays. Recent studies by the County for ABAG will be available during the Initial Phase of the Continuing Planning Process.

Summary: The above possible problems affect the local waters of the county, except Delta problems, which are of concern throughout the Bay Area and Central Valley as well as to county residents. Several of these potential problem areas are under investigation, are monitored, and mitigation measures are being taken by the cooperative efforts of appropriate agencies. Items 4 and 5, erosion, sedimentation and illegal dumping are countywide conditions and occurrences which are of a persistent rather than a critical nature, and are subject to mitigation through the existing powers and authorities of local governments, including the environmental impact review process.

A complete survey of local water quality problems and the role of surface runoff in these problems is the first step in the recommended Continuing Planning Process, Section VII. Problem analysis and mitigation measures will be undertaken by the appropriate local governmental agencies working together.

Map of Possible Water Quality Problem Areas

1. Canals of the Contra Costa County Water District
2. Hidden Lakes, City of Martinez
3. Approximate locations of proposed Delta rocks barriers.
4. East Bay Regional Park District Lakes

CONTRA COSTA COUNTY
CALIFORNIA

Map V-D

VI. ASSESSMENT OF AND RECOMMENDATIONS FOR CONTROL MEASURES

This section includes a survey of present practices, an assessment and recommendations for the list of control measures prepared by ABAG,and other measures recommended by the County. A summary of recommended measures and implementation is given in Subsection D.

Each measure is selected as:

- short-term implementation

- appropriate for future consideration on a project, site or watershed basis

For some measures, the present and future implementations are not mutually exclusive. A present practice may appear suitable for consideration for wider application in the future.

In general, the intent of the selected control measures is to incorporate water quality considerations into the decision-making process to a much greater extent than in the past. This will be accomplished by inclusion in environmental impact processes, design review guidelines and conditions of approval, and as a guideline for selection of alternative plans for flood control and drainage works, road design, and other public projects, including maintenance programs. This may be thought of as a higher level of awareness of the water quality implications of governmental actions.

The public awareness need is proposed to be met by a regionwide public education program. ABAG is recommended to undertake this program since they have a skilled staff and well developed communications throughout the Bay Area. The County, Cities, and Special Districts will cooperate in this program.

A. PRESENT PRACTICES

The County and Cities have a number of regulations and programs which benefit water quality (Figure VI-A-1). Though this was not the primary purpose of their adoption, these programs are not only providing incidental benefits to water in the county, they also indicate areas where further concern for water quality can best be expressed.

Programs for channel and storm drain clearing, street sweeping, and street maintenance, when done in a timely and proper manner, remove materials that might otherwise silt up stream and reservoirs, or permit curb-side noxious substances to be washed into receiving waters. Because they are existing programs they offer opportunities for program management to implement additional water quality concerns in the shorter term future.

Street sweeping, when properly done, is reported to remove a large part of street pollution. For this reason the County made a special survey of street sweeping. The results are shown in Figure VI-A-2. Recommended street

FIGURE - VI A

Survey Of Present Practices

Ordinance	C C County	Antioch	Brentwood	Clayton	Concord	El Cerrito	Hercules	Lafayette	Martinez	Moraga	Pinole	Pittsburg	Pleasant Hill	Richmond	San Pablo	Walnut Creek
Grading & Erosion Control	Yes	Yes UBC-ch70	No							Yes						Yes
Litter Control	Yes	Yes AMC-ch3	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes		Yes
Creek	Yes	County	County	County	County	Yes	County	County	County	County	No		County	Yes		County Yes
Toxic Substance		No	No				Prohibited									
Animal Control		County	No				County				Yes					County
Direct Discharge	No	Commercial Properties Required	No	No	No	Not Permitted	No Planning to Eliminate Root Gutters	Allowed	Not Permitted			No	Commercial Allowed			Prohibited
Cross Connections	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted	Not Permitted
Detention-Retention Ponds	Planned	Not Planned	Planned	Not Planned	Not Planned	Not Planned	Planned	Planned	Not Planned	Not Planned	Not Planned	No	Planned	Yes		Not Planned
Storm Drain Maintenance	Regular Program	As Required	As Required	As Required	Regular Program	Regular Program	Regular Program	Regular Program	As Required	As Required	As Required	As Required	Regular Program	Regular Program		Regular Program
Drainage	Yes	County	No	Yes same as County	Yes	Yes	County	County	UBC	Yes	Yes Similar to County	Yes County	County	Yes	County	County Yes
Slope Density							Yes				Yes					Ordinance

sweeping measures to increase efficiency are included in Figure VI-B. This concept is detailed in Section VI-B and C, Control Measures.

B. CONTROL MEASURES REQUIRED TO BE CONSIDERED

ABAG requires consideration of a list of control measures. This assessment (Figure VI-B) is based on three relevant objectives approved by the County's Public Participation Committee and Advisory Task Force.

- To assess control measures according to their effectiveness in mitigating pollution problems in the receiving waters.

- To evaluate control measures according to the principle of best management practices.

- To evaluate control measures according to their cost-effectiveness and feasibility of implementation within the existing governmental structure.

Note: "Best management practices" (BMP) is somewhat vaguely defined by EPA for precise assessment. This report defines BMP as essentially "good housekeeping" or land maintenance practices which do not require significant expenditures for construction of permanent facilities, investment or capital improvements. For example, temporary or permanent grading on construction sites is considered BMP, but construction of a separate off-line retention basin is not. It is admitted that this definition is not ideal, but it is precise enough for assessment purposes. In Figure VI-B, "Comments" column, contains a notation on BMP.

C. OTHER MEASURES INCLUDED IN THE PLAN

The following measures are included in this plan, as developed in the County, and are not included in Figure VI-B.

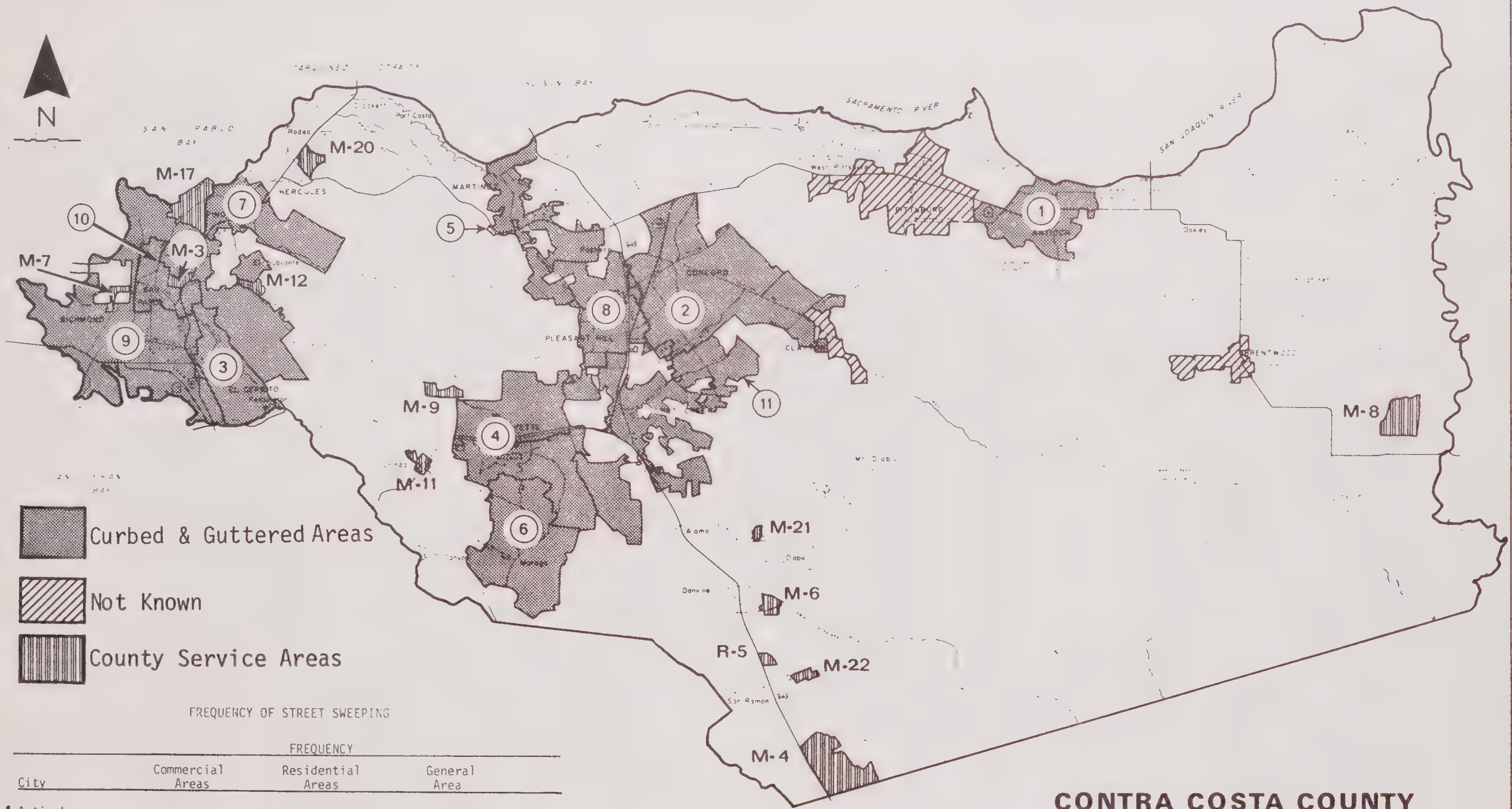
1. EIR - include items for discussion which more fully reflect water quality considerations. Include in mitigation measures.

2. Project Review Guidelines - for all public and private construction projects.

   Conditions of approval recommended by Public Works and Planning Departments for:

   a. Project design features
   b. Construction period land maintenance
   c. Post-construction period land maintenance

   The emphasis for these guidelines should be on soil erosion management for all construction projects, and should also include further consideration for concentrations of animal wastes, pollutants, and toxic materials, when appropriate.



CONTRA COSTA COUNTY
CALIFORNIA

FREQUENCY OF STREET SWEEPING

	FREQUENCY		
City	Commercial Areas	Residential Areas	General Area
1 Antioch			once/week
2 Concord	3/week	once/6 weeks	
3 El Cerrito	Daily	2/ month	
4 Lafayette			2/month (Mt. Diablo Blvd. only
5 Martinez	2/week	2/month	
6 Moraga			4/year
7 Pinole			once/8 days
8 Pleasant Hill			2/month
9 Richmond	1/week	1/month	
10 San Pablo			once/month
11 Walnut Creek	3/week	2/month	

County Service Areas all 1/month except:

M-8	4/Year	M-21	Pending
M-11	1/Week	M-22	Pending

ASSESSMENT AND RECOMMENDATIONS ON CONTROL MEASURES PREPARED BY ABAG

Group A Measures to Reduce Accumulation of Pollutants Prior to Runoff

Control Measure	Description	Effectiveness	Other Environmental Impacts	Cost Effectiveness and Social Impacts	Implementing Agencies	Recommendations	Comments
A-1 Provide more frequent street cleaning.	Increase in the frequency of street cleaning in densely populated or commercial areas.	Depends on timing related to storms. Sweeping within 5 days of a storm would materially reduce the soil particles and vehicle caused substances which are located close to the curb. This measure is not effective if the sweeper does not sweep the gutter.	Visual quality benefits. No known adverse impacts.	Costs would be marginal to moderately high, depending on local circumstances. No known adverse social impacts.	County-Service Areas Cities	1. Encourage the county and cities to review sweeping schedules in densely populated and commercial areas to determine if a more efficient schedule can be devised	Suburban shopping centers with large parking lots should also be swept, with emphasis on the days preceding an expected storm. B.M.P. - Yes. A "good housekeeping" measure.
A-2 Provide more efficient methods of street cleaning.	Use of more efficient street cleaning devices or methods to reduce the amount of solid particles in the street.	1. Devices. High efficienty brooms and sweepers are reported to increase effectiveness by 50% or more. 2. Methods. Higher contract specifications and training operators are reported to increase effectiveness up to 50 percent.	Visual quality benefits. No known adverse impacts.	1. Devices. Costs vary. Vacuum sweeper most costly, but also most effective, if accompanied by efficient methods. 2. Methods. Administrative and training costs may be small compared with increased efficency.	County-Service Areas	Methods 1. If training programs are offered, agencies should participate. 2. Encourage agencies which contract sweeping to review spcifications for opportunities for greater efficiency. Devices At the time equipment is replaced, agencies should consider the benefits of purchasing high efficiency sweepers, brushes and other devices.	B.M.P. - Yes. A "good housekeeping" measure.
A-3 Repair Streets	Repair of streets in order to increase street cleaning efficiency and to reduce the accumulation of pollutants.	Marginal benefits.	Public safety benefits. Visual quality benefits. No known adverse impacts.	Cost not justified by water quality benefits alone. Well maintained streets and roads help to maintain property values and sence of pride in the community.	County Special Districts (Parks and Recreation Roads) Cities	1. Maintain existing practices. 2. Include water quality. benefits as a consideration in street repair guidelines.	B.M.P. - Yes. A "good housekeeping" practice.
A-4 Control certain chemicals	Control use of certain chemicals which are known sources of pollutants. Such products include lawn fertilizers, pesticides, and other toxic chemicals used by householders.	Effectiveness depends on amounts of these substances in use, and proportion of those amounts which reach surface waters.	Probable benefits to local environmental quality, including wildlife and beneficial uses of surface waters. Possible benefits to human health.	Not known	Federal and State regulations. County Health Dept. County Dept. of Agriculture.	1. Include in regional public education program. 2. (Reference Solid Waste Plan)	Individual choice to avoid use of improper disposal of hazardous materials is believed to be the most effective low cost long term control measure. B.M.P. - Yes, if program to deter illegal dumping. No if new permit or other control program. Difficult to Enforce.
A-5 Restrict auto parking.	Restriction of auto parking in order to increase street sweeping effectiveness.	Reported to greatly increase effectiveness of sweeping by permitting sweeper to reach gutter.	Visual quality benefits. May reduce maintenance costs for cleaning inlets. No known adverse effects.	Very costly to post and enforce. Existing voluntary program be effective at insignificant administrative cost.	County-Service Areas. Cities	1. Maintain existing practices where now practiced. 2. Expand program on voluntary basis to other swept areas.	B.M.P. - Yes.
A-6 Control use of lots and streets	Reduction in the type of activities such as painting and car washing, auto repair and maintenance.	Effectiveness depends on degree of use prior to institution of control. May be highly effective on specific misused sites.	Visual quality benefits.	Administrative and enforcement costs not known. Maintain property values and pride in community.	County Cities	1. Maintain existing levels of enforcement. 2. Consider stronger enforcement if a problem area develops.	County and cities have ordinances preventing car repair outdoors in residential areas. Enforcement very difficult. Violations are isolated and infrequent, but, when identified, may be persistent. Car washing is permitted as an auxiliary residential use. B.M.P. - Yes.
A-7 Control dumping.	Control of dumping of residential, commercial and industrial wastes on lots and streets.	Minor to major, depending on location, nature and amounts of substances controlled.	Probable environmental benefits, including preservation of wildlife. Possible health benefits to man. Visual quality benefits. Prevent flooding from clogged gutters and roadside drainage ditches. No known adverse impacts.	Depends on seriousness of problem and level of enforcement. Enforced to same extent by RWQCB and state agencies (DFG). Possible preservation of property values.	State, RWQCB, County, Cities. Possibly Water Districts, County Health Departments.	1. Maintain present practices. 2. Increase enforcement where needed to highest practical level. 3. (Reference Solid Waste Plan)	1. Now against state law (in state water) and county-city ordinances. 2. Prohibited in commercial and residential areas. 3. Commonly practical in heavy industrial districts. B.M.P. - Yes.

Figure VI-B

Control Measure	Description	Effectiveness	Other Environmental Impacts	Cost Effectiveness and Social Impacts	Implementing Agencies	Recommendations	Comments
A-8 Control littering and dog droppings.	Control littering and dog droppings on streets and gutters.	Littering. Effectiveness not known. May be marginal for most cities that sweep on a regulation basis. Dog Dropings. In suburban cities, this does not become the costly problem it does in say, New York City. Effectiveness would be marginal, if any.	Visual quality benefits. No known adverse impacts.	Not known.	County Cities	1. Maintain present levels of litter control. 2. Litter and dog droppings control enforcement should be increased in areas in which it is perceived as a problem.	B.M.P. - Yes.
A-9 Control automobile and other emissions.	Control of emissions from mobile and station any air pollution sources in order to lessen the amount of fallout which contribute (SIC) to runoff pollutants.	- - - - - - - - -This control measure will be considered by ABAG and not by the local agencies - - - -			Federal, State	Consider in A.Q. standards.	It would be very useful to have an estimate of types and amounts of substances in fallout. Better oil seals would help.
A-10 Control direct discharge of pollutants	Control of direct discharge to storm water collection system of pollutants such as paint, motor oil, pesticides, chemicals, and other hazardous liquid and solid wastes.	This is reported to be an illegal dumping problem which occurs randemly throughout the county. Control would prevent a large variety of substances from reaching surface waters.	Maintain natural creek environment, including wildlife. Maintain recreation and other beneficial uses of the counties waters. Maintain visual quality. No known adverse impacts.	If achieved by personal choice, costs would be low and may be offset by reduced maintenance costs. A new program with enforcement personnel would be very costly, as a estimate, $100,000 per year.	County Cities Co. Health Dept.	1. Maintain existing level of enforcement. 2. Encourage cities to increase enforcement in problem areas. 3. Include in regional public education program. 4. In areas where illegal dumping is perceived as a problem, adequate trash pick-up, recycling centers, or other options for legal and safe disposal should be developed.	Dumping without a permit is a violation of state law (in state waters), city ordinances, and county regulations for public health (if a health problem). Individual choice, plus provisions of legal disposal means, is believed to be the best long term control. B.M.P. - Yes, if achieved by personal choice. No, if new program.
A-11 Clean storm water system.	Periodic flushing and cleaning of storm drains and removal of debris from channels, pipes, inlets to prevent accumulation of solids in the collection system, perhaps keyed to prediction of rain.	Effectiveness not known. Flushing without removal just moves the material to another area.	Prevent flooding from clogged drainage systems.	Cost of present practice not known. Water quality benefits not known. Flood prevention protects property.	County Cities	1. Maintain present level of maintenance as funds permit.	As presently practiced by the county and cities, cleaning and bush removal on an as needed basis, is keyed to the rainy season. This practice is to maintain channel and drain capacity. B.M.P. - Yes.
A-12 Replace cross connections of sewerage systems.	Separation of any cross connections between the storm sewer system and sanitary sewer system.	Cross connections may benefit water quality if treatment capacity exists.	No known adverse imapcts.	Adding to sewage treatment capacity may be more cost effective. No known social impacts.	County Cities Treatment District	1. If cross connections are found to exist, this control should be considered as an alternative to constructing sewage treatment capacity, based on cost/benefit studies.	No known to exist to any significant extent. There may be some illegal connections. B.M.P. - No. Facilities construction.
A-13 Insure proper operation of septic tanks and leach fields.	Proper construction and maintenance of septic tanks and leach fields to prevent surfacing septic tank effluents, which would increase the BOD and bacteria loading of surface runoff.	Depends on proximity to surface waters. Construction and maintenance of septic tanks and leach fields is not reported to be a problem.	Public health benefits. Contribute to beneficial uses of surface waters.	Replacing existing systems would be more costly than warranted. No known social impacts.	County	1. Continue present practice of setting moratoria in troubled areas by State and County Health Departments. 2. If new construction techniques are developed, they should be considered for approval by the County Health Dept.	There are no reports of areas in which inadequate maintenance is causing surfacing of effluents, except areas now under moratoria. B.M.P. - Yes, if for new systems. No, if for replacing existing systems.

Figure VI-B

Group B - Measures to Control Land Use

These control measures are primarily land use requirements which would modify the amount of pollutants and runoff generated from developed areas.

This group of control measures attempts to control pollution indirectly through land use rather than being directed at pollutants themselves. Thus they are questionable in effectiveness, may cause socio-economic disruption, and are difficult to implement compared with direct methods.

Control Measure	Description	Effectiveness	Other Environmental Impacts	Cost Effectiveness and Social Impacts	Implementing Agencies	Recommendations	Comments
B-1 Develop slope density standards.	Establishment of slope density standards which would limit the development of hillside areas thereby reducing the amount of sediments and runoff.	Could be counter productive, depending on how and where applied. Benefits may be lacking unless accompanied by requirements for drainage, revegetation and construction practices.	Possible visual benefits. Protection of property.	Public costs for administration. Costs carried primarily by land owners.	County Cities	Not recommended.	Existing practice in some communities for property protection. B.M.P. - Yes, in the sense that it is a land use practice, not construction of facilities. Not a "good housekeeping" practice.
B-2 Maintain open space areas.	Concentration of urban development to minimize the impervious land surface which will increase the quantity of runoff.	Suburban cities have an abundance of perceivable land, excption commercial districts. Could be counter productive.	Lifestyle changes in most communities. Damages to environment in cities, including loss of vegetation and wildlife. Loss of visual quality.	Potential for high socioeconmic impacts	County Cities	Not recommended.	Radical social change. B.M.P. - No.
B-3 Control development patterns.	Control of certain types of land use which are known to cause high amount of pollutants or runoff in environmentally sensitive area. For example, restriction of development in flood plain or near stream channels and lakes in order to prevent large amount of pollutants from being transported directly into the waterway.	Depends on pollutants coming from a specific use.	No known adverse impacts.	Some public costs for administration. Costs carried primarily by property owner. Disruption of development patterns could cause adverse social and economic effects.	County Cities	Not recommended.	Large amount of pollution from a site-specific source should not be permitted, whether direct or indirect into storm drains. B.M.P. - Yes, in that it is not construction of facilities. Not a "good housekeeping" practice.
B-4 Develop buffer strip requirements.	Development of buffer strip such as grass lands or undeveloped open space surrounding new developments in order to reduce the amount of runoff by infiltrating or retarding storm water.	Depending on circumstances, could add to peak flow. Effectiveness would require street flow to be directed onto the buffer strip.	Applies to level land only - could cause sprawl. On impervious clay soils, could pond and breed mosquitos or pose a safety hazard to young children.	Costs carried primarily by property owners. Some public costs for administration.	County Cities	Not recommended.	Detention basins are better than buffer strips for this purpose. B.M.P. - Yes.

Figure VI-B

Reducing peak flow or total volume of runoff may or may not affect the total amount of any pollutant reaching the off-shore receiving waters. If there is a "first flush" phenomenon, questionable in watersheds which have large open space areas upstream from the cities, reducing the peak flow would not mitigate this phenomenon unless the "first flush" and peaks flow coincide.

Group C - Measures to Reduce Amount of Pollutants and the Peak Flow or Volume of Runoff

These control measures are primarily designed to reduce the total amount of pollutants and the peak flow or volume of runoff. It should be noted that modification of the peak flow alone may or may not reduce the amount of runoff or pollutants.

Control Measure	Description	Effectiveness	Other Environmental Impacts	Cost Effectiveness and Social Impacts	Implementing Agencies	Recommendations	Comments
C-1 Control of roof drains	Control of roof drains connected to storm sewers in order to reduce amount of runoff.	May retard flow. Infiltration would be minor in most cases. As surface flow, roof drain water would pick up silts, dog droppings, leaves, etc. on its way to the storm drains inlet in the street. No net effectiveness is perceived.	Inconvenience to property uses. May washout lawns, etc. May contribute to deterioration of asphalt parking lots.	Public research and enforcement costs. Private costs to disconnect. No known severe social impacts.	County Cities	Not recommended.	B.M.P. - Yes.
C-2 Construct rooftop detention and storage.	Construction of rooftop detention and storage with appropriate outlet structures in order to delay the runoff thereby reducing the peak of the hydrograph.	Depends on location. Could add to a secondary peak of the hydrograph. No information that water quality benefits would result.	No known adverse impacts.	Refitting existing buildings very costly. Very complex problem to analyze watershed to determine if costs are justified by actual peak flow reductions.	County Cities	Not recommended.	B.M.P. - Yes.
C-3 Rechannel runoff to prevent flow over critical surfaces.	Construction of channels, berms and other control structures to reroute flow around areas that have accumulated pollutants.	Effective if accumulated pollutants are contained.	Depends on nature of accumulated pollutant. Could have public health benefits.	Public administrative and enforcement costs. Costs assumed to be primarily the responsibility of the property owner.	County Cities RWQCD	1. Recommended for inclusion in guidelines for project review. 2. Appropriate for future consideration on a case-by-case basis in local areas.	May be appropriate for the construction period as well as for the life of the project. May be considered on abandoned properties. B.M.P. - No. Construction of facilities.
C-4 Redesign curb and gutter configurations.	Redesign of curbs and gutters and streets to either delay or speed up the flow of urban runoff to provide for a more uniform flow in the collection system.	Depends on application to a large area. Depends on location with regard to hydrograph of entire area.	No known adverse environmental impacts.	Watershed study and design costs would be many times higher than at present. Unless this control and several others, were applied throughout a watershed the need for flood control improvements would not be mitigated. Little berms in or near the gutter would be a hazard to bicycling.	State County Cities	Not recommended.	Design for efficient flow is customery. Retarding flow to reduce peaks as an alternative to channel improvements is best achieved by other means. B.M.P. - No. Design of facilities.
C-5 Remove debris in channels, pipes and inlet to improve flow.	Removal of large size debris such as construction and demolition debris in order to improve flow conditions in the collection system thereby reducing overflow, flooding and erosion.	Very effective in avoiding local flooding. Water quality benefits not known.	No known adverse impacts.	Costs not known, but is as normal maintenance practice, is believed to be cost effective in terms of protection of property and avoiding inconvenience. Protects property.	State (State Highways) County Cities	Present practice to maintain flow characteristics.	B.M.P. - Yes. A "good housekeeping" measure.
C-6 Regrade disturbed areas.	Regrading or tenacing of areas that have been modified by construction related events or by natural erosion, in order to reduce the amount of sediment carried off by runoff.	Effective if accompanied by revegetation.	Mitigate subsequent sliding or gullying. Mitigate subsequent flooding from dogged or silt-laden channels. No known adverse impacts.	Costs vary with size and accessibility of area. Protects property.	State (State Highways) County Cities Water and Park Districts	Present practice on a limited scale. Appropriate for future consideration on a project by project basis.	B.M.P. - Yes, a land maintenance practice.
C-7 Reseed or apply vegetative cover to bare slopes.	Reseeding or applying vegetative cover to bare slopes to prevent loss of top soil thereby reducing the amount of sediments carried off by runoff.	Moderately to highly effectively in reducing soil losses. Water quality benefits not known. Would depend on degree of excess soil loss and impact on a beneficial use of the receiving waters.	Mitigate downstream flood hazards. Protect beneficial uses of soil. Visual quality benefits. No known adverse impacts, but could require irrigation and strain limited supplies in drought years.	Cost effectiveness not know. It is probably less costly to revegetate slopes than to dredge excess silts out of the lower channel. Protects property.	State (State Highways & Parks) County, Cities, Water & Parks Districts, other public entities that own property, resource Conservation District.	1. Existing practice. A project review guideline. EIR criterion. 2. Appropriate for future. Consideration on a project or site basis. 3. Encourage land owners and the RCD to work cooperatively together to prevent excessive soil losses.	Should be related to site-specific conditions. B.M.P. - Yes. A land maintenance practice.
C-8 Stabilize channels of rivers and streams.	Stabilize channels of rivers and streams to prevent soil loss in the storm channel through erosion and undercuttting.	Highly effective, preventing bottom cutting would require bottom improvements.	Usually perceived as permanent destruction of the natural environment. Loss of visual quality.	Too costly to justify in open space areas except in specific locations. Costs up to several million dollars per mile of improvements. Protects adjacent property. Possible loss of recreation potential.	Federal (Corps of Engineers) State (Reclamation District) County, Cities - (not common) Water & Park Districts.	1. Present practice on a limited scale. Included in EIR. 2. Recommended for future consideration as a project design alternative.	B.M.P. - No. Construction of facilities.

Figure VI-B

Control Measure	Description	Effectiveness	Other Environmental Impacts	Cost Effectiveness and Social Impacts	Implementing Agencies	Recommendations	Comments
C-9 Control erosion at construction sites.	Control of erosion at construction sites by checkdams, berms, straw bales, mulch and road maintenance in order to reduce or prevent runoff from reaching major drainage channels by entrapping sediment that has been carried off the construction site.	Highly effective in preventing excess silting in streams. Water quality benefits not known.	Mitigates downstream flooding. Protects natural creek environment. Reduces maintenance costs for clearing silts from streams. Prevents silting in gutters and storm drains. No known adverse impacts.	Cost effectiveness not known. Probably cost effective regarding public expeditures. Costs carried primarily by developers.	State (State Highways & Parks) County, Cities, Special Districts.	1. Existing practice to some extent. 2. Recommended for inclusion in project review conditions of approval. 3. Encourage agencies to review present practices to determine if better enforcement needed.	For long term benefits, coordinate with revegetation programs. B.M.P. - Yes, if considered a "good housekeeping" practice. No, if considered construction of temporary facilities.
C-10 Regulate construction of activities in time or space.	Regulations of construction schedules to insure that runoff might be minimized either by staging or by scheduling projects with a consideration of runoff impacts.	As stated in Ist column, would be counter productive in this climate region. As stated in column two, is an existing practice believed to be effective in mitigating excessive soil losses.	Depends on interpretation of control measure.	Some public costs for administration costs carried by developer. Possible economic disruptions.	State (Highway & Parks) County Cities Special Districts	1. Not recommended as stated in first column. 2. Minimize soil exposed during rainy season.	With the exception of emergency repairs, grading and laying of foundations is required and/or customary in this climate region, during the dry season. B.M.P. - Yes. A land management practice.
C-11 Construct permanent berms for critical sources.	Construction of permanent berms for critical sources such as gas stations, garages, and feedlots to prevent runoff carrying critical constituents (metals, hydrocarbons, oil and greses) from reaching the storm water collection system.	Not known. Depends on alternative method of disposal could be effective if widely applied.	Could benefit water quality in a locally troubled area. Benefits to offshore receiving waters depends on impacts or beneficial uses. Not yet known.	As stated, control covers only part of cost. Also requires tie in to sewage treatment plant or some other disposal means.	State RWQCB County Cities	1. Present practice as required by RWQCB (feedlot) 2. Present practice in heavy industrial areas. 3. Recommended as a new project review guideline with conditions of project approval.	If flow is directed to sewer lines, treatment plan may not accept or may not remove substances, depending on the substance. B.M.P. - No. Construction of facilities.
C-12 Use energy dissipators to reduce potential or erosion or transport of solids.	Construction of dissipators of stream channels to reduce sediment load and prevent channel erosion.	Moderately to highly effective for some distance downstream. Low to moderate effectiveness at a distance downstream from the structure.	Protection of the natural environment.	Costly, but may be less costly than channel stabilization and bottom stabilization. Protects adjacent property.	County Cities-possibly but rarely Special Districts	1. Present practice on a limited scale by county, possibly park districts. 2. Not recommended for increased use at this time.	A flood prevention alternative Requires evaluation of all conditions in order to make the decision. B.M.P. - No. Construction of facilities.
C-13 Increase perviousness surfaces.	Increase of pervious surface through construction of Dutch drains or porus asphalt paving in flat areas to allow water to infiltrate into the ground in order to reduce runoff.	Infiltration effective in some soils for a relatively short term. Not useful in impervious clay soils. Benefits to quality of receiving waters questionable. Effectiveness reduced over time until system fails.	No known adverse environmental impacts.	Dutch drain - cost depends on size and depth of excavation required. Costs carried by development property owner. Porus asphalt - relative costs for installation not known. Probable damage to subgrade requiring costly maintenance.	County Cities Special Districts Districts (Park)	Not recommended	Impervious clay soils predominate throughout the county, particularly on valley floors. Effective life not known. Voids filled with fine particules. B.M.P. - No. Alternative construction practice.
C-14 Require minimum of pervious surfaces for new construction.	Requiring new construction projects to maintain a certain percent of the land to be pervious.	Marginally effective in increasing infiltration. Benefits to quality of receiving waters questionable.	Maintenance of environmental quality, including vegetation and wildlife. Visual quality benefits. Some reduction in energy use for air conditions. No known adverse environmental impacts.	Some administrative costs. Costs carried primarily by developers and property owners. Some reduction in costs of air conditioning. Enhances property values and pride in community.	County Cities	1. Present practice established by county and city regulations for maximum allowable lot coverage, except in some commercial districts.	B.M.P. - No. Project design and construction.
C-15 Use efficient tillage and plowing practices for agricultural areas.	Use of efficient tillage and plowing practices for agricultural areas to minimize areas disturbed thereby reducing runoff and soil erosion.	May be counter productive. Rough tilled land is often more permeable than level bare soil.	No known adverse impacts.	Unwarranted restriction on agricultural practices.	RCD with cooperation of land owner.	Not recommended.	Farmers rarely till more land area than needed. B.M.P. - Yes. A land management practice.
C-16 Modify drainage basin.	Modification of land drainage to reduce the flow and to change the routing of runoff.	Benefits to quality of receiving waters highly questionable.	Damages to natural environment.	Cost depends on scale of effort. As stated would be unduly costly. Illegal-affects water rights.	No existing local authorities. Federal and State Water projects	Not recommended.	B.M.P. - No. Construction project.
C-17	Modify the weather to limit the	- - - - - This control measure will be considered by ABAG and not by the local agencies - - - - - -					

Figure VI-B

Group D - Measures to Treat and Store Runoff

These measures are primarily designed to treat runoff directly or store flows for later treatment. They are mostly high capital intensive structural solutions. It should be emphasized that these measures will only be considered at a reconnaissance level in preparing the county surface runoff management plan. Reconnaissance level means that the investigation would be limited to the following:

*A brief description of the control measure including the type of proposed facilities and treatment process and the capacity and method of operation of the facilities.

*A map of the county showing the location of major proposed facilities.

*An estimation of capital and operation and maintenance costs based on cost curves provided by ABAG.

A relationship between surface runoff and damages to beneficial uses of theoff-shore receiving waters has not been established such that construction of costly facilities is warranted. Smaller scale projects may be suitable for protection of lakes and reservoirs which do not have the flushing and dilution benefits of tidal and free-flowing waters.

Control Measure	Description	Effectiveness	Other Environmental Impacts	Cost Effectiveness and Social Impacts	Implementing Agencies	Recommendations	Comments
D-1 Trap sediment and solids by use of catch basin.	Construction of large catch basins to top sediments carried by the storm water.	May be counter productive. Sediments are reported to benefit certain receiving waters. A sizeable amount settles out near the mouth of the creek anyway, and does not reach offshore waters. Other solids may damage beneficial uses. Catch basins would help to trap these in urban areas.	No known significant adverse environmental impacts.	Not believed to be cost effective. No known social impacts.	County Cities RCD (with cooperation from landowners)	Not recommended.	An annual supply of soft loose sediments is reported to benefit Suisun Bay from (Basin Plan). The largest share of sediments in the county's offshore waters comes from the Delta and open space areas. B.M.P. - No.
D-2 Impound runoff in upstream channels.	Upstream impondment of runoff to modify the peak flow.	If a "first flush" phenomena exsits, this measure could be counter productive in that it could reduce dilution during the critical first hour or two of storm runoff.	Possible damages to the natural environment.	Not believed to be cost effected. No known social impacts. Some taking of property required.	County Cities (possible but rarely)	1. Existing practice to a limited extent as an alternative to channelization. 2. Not recommended for water quality purposes.	B.M.P. - No.
D-3 Construct on-line or off-line storage.	Construction of aboveground or underground storage facilities including ponds and tanks and oversized interceptors to which the storm water flow can be diverted and released after the peak storm flow.	Effectiveness depends on location with regard to watershed charactertistics, and whether or not harm is being caused to beneficial uses.	No known adverse environmental impacts. Would have to be evaluated on a project basis.	Costly. Not warranted. No known significant social impacts. Some taking of property.	County.	1. On-line-not recommended. 2. Off-line-existing practice to some extent as an alternative to channelization. Not recommended for water quality purposes.	B.M.P. - No.
D-4 Use existing capacity of storm sewers for storage of flows.	Use existing capactiy of storm sewer storage of flow. It may require use of remote sewering and computer-directed control system that provide centralized control of regulator and pumping stations on trunk and interception sewers to optimize storage.			Costs not warranted.	County Cities	Not recommended.	B.M.P. - No.
D-5 Construct treatment facilities.	Construction of treatement unit processess. Such unit processes can be added to the existing facilities or constructed as new facilities for storm water.			Costs not warranted.	County Cities Sewage Treatment District	Not recommended.	B.M.P. - No.
D-6 Use capactiy of existing treatment plants.	Use of available capacity at existing treatment plants to remove pollutants from storm waters. Such a measure would require flow equalization and storage.			Costs not warranted.	County Cities Sewage Treatment Districts	Not Recommended.	Some wastewater treatment plants are planned to provide capacity to treat wet weather infiltration into sewers.
D-7 Prevent direct discharge of storm water into receiving waters.	Prevention of direct discharge of storm water into receiving waters by routing of treated or untreated storm waters to artificial lakes, or irrigation ponds.			Costs not warranted.	County Cities RCD	Not recommended.	B.M.P. - No.

Figure VI-5

3. A regional public education program including at least the following items:

   a. Littering
   b. Illegal dumping
   c. Indiscriminate use of toxic materials
   d. Proper disposal of oil and grease, paint, animal wastes, and toxic or hazardous substances.

D. SUMMARY OF CONTROL MEASURES

This summary check list of recommended measures is for convenience. Understanding the proposed control measures requires reading the text and Figure VI-B.

1. Existing programs and practices in which further consideration of water quality can be incorporated:

   a. Environmental Impact Reports
   b. Guidelines for public plans and programs
   c. Guidelines for public and private construction projects
   d. Guidelines for land management in the post-construction period
   e. Guidelines for the development of new ordinances and regulations
   f. Cooperation and encouragement for open space land management practices.

2. Other measures included in the plan:

   a. A regional public education program
   b. The continuing planning process, Section VII, to aid jurisdictions to prepare water quality wording for adoption, will enable the County to proceed speedily to begin the recommended measures
   c. Monitoring. This measure depends on funding from other than local sources.

3. Additional measures appropriate for future consideration on a project, or site basis, from the ABAG list, Figure VI-B:

   a. Control use of lots and streets
   b. Control dumping, littering and livestock wastes
   c. Control direct discharge of pollutants
   d. New septic system design and construction techniques
   e. Rechannel runoff to prevent flow over critical areas
   f. Regrade disturbed areas
   g. Revegetation of bare slopes
   h. Stabilize stream channels.

4. Most of the above recommended control measures are from Figure VI-B. The recommended control measure and numbers from Figure VI-B are given below as a checklist.

A-1 Encourage the County and cities to review sweeping schedules in densely populated and commercial areas to determine if a more efficient schedule can be devised.

A-2 If training programs are offered, agencies should participate.
- Encourage agencies which contract sweeping to review specifications for opportunities for greater efficiency.
- At the time equipment is replaced, agencies should consider the benefits of purchasing high efficiency sweepers, brushes and other devices.

A-3 Include water quality benefits as a consideration in street repair guidelines.

A-4 Include (chemical control) in the regional public education program.

A-5 Expand (parking control) on a voluntary basis to other swept areas.

A-6 Consider stronger enforcement (of lot and street controls) if a problem develops.

A-8 Litter and dog droppings control enforcement should be increased in areas in which it is perceived as a problem.

A-10 Encourage cities to increase enforcement in problem areas (direct discharge of pollutants).
- Include in regional public education program.
- In areas where illegal dumping is perceived as a problem, adequate trash pickup, recycling centers or other options for legal and safe disposal should be developed.

A-12 If cross connections are found to exist, this control (replace cross connections) should be considered as an alternative to constructing sewage treatment capacity, based on cost/benefit studies.

A-13 If new construction techniques (for septic systems) are developed, they should be considered for approval by the County Health Department.

C-3 (Rechannel runoff) Recommended for inclusion in guidelines for project review.
- Appropriate for future consideration on a case-by-case basis in local areas.

C-6 (Regrade disturbed areas) Appropriate for consideration on a project-by-project basis.

C-7 (Revegetate) Include in project review guidelines.
- EIR criterion.
- Appropriate for future consideration on a project or site basis.
- Encourage land owners and the RCD to work cooperatively together to prevent excessive soil losses.

C-8 (Stabilize channels) Recommended for future consideration as a project design alternative.

C-9 (Construction erosion) Recommended for inclusion in project review and conditions of approval.
- Encourage agencies to review present practices to determine if better enforcement needed.

C-10 (Construction erosion) Minimize soil exposed during rainy season.

C-11 (Permanent berms) Recommended as a new project review guideline with conditions of approval with conditions of project approval.

E. MEASURES NOT INCLUDED

Control measures from Group B and D, Figure VI-B, are not recommended. Group B includes four measures to control land use:

1. Develop slope density standards
2. Maintain open space areas
3. Control development pattern (as avoiding flood plains)
4. Develop buffer strip requirements

Evaluation by County planners and engineers has led to the conclusion that these practices could be markedly counter productive regarding peak flows and substances in surface runoff, or could cause other adverse and inacceptable effects, because of the physical nature of the county, typical of the Bay Area region.

In this geologically young region, with parallel ranges separated by narrow valleys, watersheds tend to be long and narrow, with very little land of slopes from 5 to 15% (rolling hills). The level valley floors give way to steep slopes of 15 to 25%, and more. Because of the clay composition of the soils, the Mediterranean dry-summer climate type with 12 to 25 inches of rain during the 5 month winter rainy season, steep slopes and the long narrow configuration of many watersheds, the proposals in Group B would tend to be ineffective here.

1. Slope density standards, expressed in regulations or as policy, existing several cities and in parts of the County. Slope density is of interest for visual quality, maintenance of open space, and protection of property. However, it is recognized that building at a very low density of 1 to 10 acres per dwelling may also result in more road cuts, utility lines, grading for berms and other land disturbances. Given our steep slopes, grading for berms and erosive clay soils, this practice requires more in the nature of construction erosion control, not less.

2. Regarding open space area, concentrating urban development to minimize impervious land is not a workable concept in our typical low density single-family suburban communities. One should remember that, although low density means more streets per capita, it also means more lawns and trees per capita; i.e., more open space within the city. Some densification is taking place as older core areas are redeveloped, but densification to the radically greater extent that would be required under this control would not be socially or economically acceptable. Also, though it might decrease the amount of paved streets, it would also increase the concentrations of noxious substances in the runoff.

3. Avoiding flood plains here would be difficult to achieve since short of the available level land, created by flooding, lies in historic flood plains and much of this is presently developed. The County is now preparing a creek setback ordinance to prevent structures from encroaching close to the creek channel. This will facilitate drainage and channel repair work, and will protect property from bank failure, but is not believed to increase water quality.

4. The buffer strip concept to permit infiltration of surface runoff into the ground does not work well on our impervious clay soils. Many low spots can be observed to pond water for several days after a storm and during a normal rainy season, one storm follows another in quick succession. The ponds which would be created in buffer strips would be a hazard to young children, would be unsightly and would breed mosquitos.

In conclusion, the physical nature of this area is such that the above control measure, if they are applicable at all, would have to be very carefully thought out and would have very few appropriate locations.

Group D, 1 and 2, three measures to treat and store runoff, were not recommended for similar reasons. The concept of retarding runoff on the land or in stream channels is an interesting concept in theory, but is difficult to apply on steep land or on impervious soils. Storage ponds are subject to rapid filling during the frequent and intense skiing storms in a normal rainfall year, but because of the immense amount of steep undeveloped land, largely in grass not forest, the natural erosion rate is high and fills ponds or check dams rapidly with fine, impervious clays. This is a persistent maintenance problem in reservoirs, lakes and the lower reaches of the larger structures and while it can be mitigated by more careful construction site practices, we realize it is in the nature of this region and cannot be prevented. The County is planning detentions basins as a flood control alternative to channelization, but reports that these will only hold a larger flood peak for a few hours, and so will not provide any substantial water quality benefits. In any case, Items in D are very costly and could only be justified if downstream dredging costs would be materically reduced. Given the large sediment load from open space areas, this cost tradeoff is not believed to be justified.

How to reduce urban-caused increases in runoff is a matter of interest here, but is difficult to implement because permeable paving silts up rapidly, retention ponds silt up and must be cleaned, and impervious soils make swales or low spots ponds in winter--followed by barren land cracked clay during the

summer and fall. At present, our traditional engineering for efficient drainage appears to be the most safe and practical system. However, during the Continuing Planning Process, new and innovative ideas may be gained. If these appear workable in this environment they will be given serious consideration. Saving natural creeks where possible is also a strong community goal.

VII. THE CONTINUING PLANNING PROCESS AND IMPLEMENTATION

EPA requires a Continuing Planning Process and specification of implementing powers. The purpose of this section is to meet those requirements by setting forth a process to identify and mitigate water quality problems which may be caused by surface runoff or by pollutants in surface runoff, to coordinate and monitor activities within the County, and to prepare the required reports.

A. ORGANIZATION

The County Planning Department will act as Lead Agency to:

- prepare the Initial Phase Work Program
- coordinate activities within the County
- conduct the public participation program
- monitor and document accomplishments
- prepare the required annual report

Staff participants on the Planning Committee will encompass local governmental agencies with jurisdiction over water bodies in the county and land activities which may affect water quality, including:

- all incorporated cities, primarily Departments of Planning, Grading Inspectors and Public Works
- water and sewer agencies
- County departments with county-wide authorities, i.e.: Public Works, Health
- recreation agencies
- Resource Conservation District
- others as may be appropriate

The composition of the Planning Committee may vary as specific issues are addressed.

The Public Participation Committee will include representatives of the three public specified by EPA:

- Public agencies
- Special interest groups
- Citizens in general

B. STEPS IN THE PLANNING PROCESS

The Initial Phase Work Program will detail the organization briefly noted above. A preliminary survey of potential water quality problems in the county has been made. Due to circumstances, this survey is not yet complete. Therefore, in order to complete our information on water quality conditions in the county, and in watersheds lying vastly in this county and partly in Alameda County, the first step in the planning process will be water quality problem identification and guidelines for determining whether or not a water quality problem exists. Also included will be guidelines for determining whether or not a future water quality problems can be predicted from surface runoff.

The second step will be to determine when and in what way surface runoff has caused or is causing water quality problems; whether by construction erosion, land management, illegal dumping, or other activities. A variety of causes is expected to be determined, with seasonal and locational differences in adverse impacts on beneficial uses.

The third step will be to determine means of correcting or mitigating water quality problems caused by surface runoff. These measures are expected to vary from simple and direct treatment on law enforcement in some cases to wide spread erosion control in other cases.

Step four, mitigation, will be carried out by several approaches, including but not limited to law enforcement, adoption of ordinances and by requiring conditions of approval for new projects. The acceptable approach will depend on where differences in ordinances, regulations, enforcement and practices exists. The Lead Agency will aid cities and other jurisdictions in preparing regulations, where needed, in preparing language for improvement of regulations, in evaluating the water quality and mitigation section of Environmental Impact Reports, and in preparing guidelines for project and program approval. Any of these would be required to be approved or adopted by the elected officials of a jurisdiction or district before they would be enforced. Staff can not impose regulations, guidelines or policy on a governing body.

The County will undertake a monitoring program if funded by other than local sources. Such a program should be designed to investigate surface runoff at or near suspected pollution "hot spots", should be coordinated with other monitoring programs in adjacent counties or the region in order to begin to build a solid and reliable data base for future action. Monitoring stations should be located for water quality study purposes.

C. INITIAL PHASE ACCOMPLISHMENTS

By the end of the Initial Phase, approximate end June 1979, it is expected that the following will have been accomplished:

- identification of water quality problems in the County, including watersheds in Contra Costa and Alameda Counties.
- identification of surface runoff contributions to such problems
- identification of water use and land use control and mitigation measures
- preparation of regulations, ordinances, programs, EIR and project guidelines and policy considered appropriate in response to the problem and cause analysis
- adoption of regulations, ordinances, programs, guidelines and policy by all or some of the cities, county, and other jurisdictions
- demonstration projects and areas. These may include animal waste control, erosion control, land management practices and other programs. The city or district undertaking the program will be asked to evaluate its effectiveness as guidance to others in the county. No specific program is proposed at this time. Sample programs will depend on a committment by a city or district to undertake them.

D. ANNUAL REPORT

The Lead Agency will prepare the required Annual Report and submit to EPA, EPA's designated authority and other interested agencies. The Annual Report will include a status report on the Items in C, Accomplishments, plus other items as required.

E. IMPLEMENTATION

The Lead Agency will monitor progress made during the Initial Phase. Implementation of Lead Agency tasks is a responsibility of the County. Adoption and approval of regulations, ordinances, program, guidelines and policy will be by the County, cities and other jurisdictions. Land management cooperation with the Resource Conservation District will be on a voluntary basis.

During the last six months of the Initial Phase, the Lead Agency with the Planning Committee, will determine whether or not there are tasks which should be accomplished during the longer range future, prepare a brief report, and, if appropriate, a brief Work Program delineating such tasks.

The implementation principles governing the above process is as follows:

- The most practicable local level of planning and implementation provides the best opportunities for public participation and for "fine tuning" programs to meet specific water quality needs.

- Planning and implementation should be under the same authorities because planning without regulatory powers can be a meaningless process, but regulation without planning can lead to errors.

- Regional problems do not necessarily require regional or state government controls. Local governments working together to solve local problems can often yield regional environmental benefit.

- It is vital to identify and analyze problems and causes before attempting to institute control measures. An effort to enforce control measures on cities or other jurisdictions without adequate justification substantiated by fact would fail.

- There are legitimate and genuine differences in evaluating the magnitude of problems in priorities for expenditure of government revenues and in social goals. These advisory positions color all government decisions and they often cannot be resolved by asking groups with different perception to sit down together and talk. Allowing for those differences is the heart of the democratic process and will be respected during the implementation of this plan.

F. ENFORCEMENT

It is not at present known whether EPA will retain it authorities for enforcement of Surface Runoff Management Plans, or will delegate this authority to the State. It is believed by many persons that enforcement authority will ultimately rest with the Regional Water Quality Control Board and be administered through the Porter-Cologne Act and/or National Pollution Discharge Elimination System permits for areas. County compliance can be demonstrated in Annual Report and can be evaluated for compliance by the RWQCB or other government agency with enforcement powers.

G. COSTS

All costs for the Initial Phase are local costs, primarily in terms of staff time contributions. Additional costs will fall on the County for Lead Agency preparation of materials and reports the public participation program and cooperating in the proposed regional public education program. It is not possible to predict these costs with accuracy at this time. A rough estimate is from $30,000 to $60,000 for the Initial Phase planning period. A monitoring program would depend on other than local sources of funds. If new or expanded programs are imposed on the County, or its cities or special districts by a Federal or State government agency, these will also be funded from other than local sources.

CONTRA COSTA COUNTY

SURFACE RUNOFF MANAGEMENT PLAN

APPENDIX A

TECHNICAL APPROACH

September 1977

CONTRA COSTA COUNTY

SURFACE RUNOFF MANAGEMENT PLAN

APPENDICES

CONTENTS

TABLES

Table

FIGURES

Figure

TECHNICAL APPROACH

The quality characteristics of surface or stormwater runoff have, in the past, received very little attention within Contra Costa County. As a result of this inattention a very elementary and simplistic "technical approach" was adopted in this initial investigation consisting of the following activities:

1. Delineation of study area;
2. Development of fundamental concepts;
3. Accumulation and review of existing data, past studies;
4. Identification of surface runoff related problems;
5. Determination of surface runoff quality characteristics;
6. Quantification of surface runoff constituent loadings upon Bay-Delta waters and comparison to other sources.

AREA COVERED BY STUDY

The topography and water resources development within and adjacent to this county is such that significant areas do not normally drain directly to the San Francisco Bay - Delta Estuarine System.

These areas are as follows:

1. Approximately 41,800 acres are within the Alameda Creek Watershed and are included within the study area for the U.S. Corps of Engineers Upper Alameda Creek Watershed Study.

2. Approximately 16,700 acres drain into East Bay Municipal Utility District's (EBMUD) Upper San Leandro Reservoir. Consideration of this area is included within the Surface Runoff Management Plan for Alameda County.

3. Approximately 18,300 acres drain into EBMUD's Briones and San Pablo Reservoirs. Because of the infrequent nature of releases from these reservoirs to San Pablo Creek and of the very substantial diluting effects of these reservoirs (the primary supply for which is the very high quality water from the upper reaches of the Mokelumne River watershed) it has been assumed that such releases as may occur contain no pollutants.

4. Approximately 56,100 acres of low lying lands within the Delta area of the county have no natural specific outlets to receiving waters. Surface runoff, when it does occur within this area, is physically pumped at a very slow rate into the receiving waters. A large percentage of the time however, most of the precipitation is either retained as soil moisture or infiltrated to become part of the natural water table.

WHAT IS SURFACE RUNOFF

For the purposes of this study surface runoff is defined as those waters resulting from precipitation which flow overland and enter storm drains, ditches and creeks. This definition eliminates from consideration those waters which

infiltrate the soil mantle and may eventually show up in natural waterways. It also eliminates the continuous flows in several of the county's creeks which result from natural springs, excess lawn and garden waters, gutter flow from a variety of uses such as car washing, fire water, swimming pool backwash water, leachate from septic tank leach fields etc.

WHAT DOES SURFACE RUNOFF CONTAIN

Heretofore the major considerations of surface runoff have been related to its quantity of flow and its myriad effects upon life and property and very little consideration has been given to what surface runoff contains. The importance of this factor is emphasized by the coined phrase: "When a city takes a bath what do you do with the dirty water?" Surface runoff, particularly that emanating from urban areas, contains substantial amounts of foreign materials which under certain conditions can be defined as pollutants.

As can be surmised a very wide variety of constituents can be found in varying concentrations in urban surface runoff. For the purposes of this study a rather limited list of constituents have been examined. The constituents examined in this study closely followed the list of constituents monitored by point dischargers (municipal wastewater treatment facilities and industries discharging directly to receiving waters). For the monitoring program the following constituents were analyzed for in each sample collected:

BOD5 (five day biochemical oxygen demand)

Suspended Solids

Volatile Suspended Solids

Dissolved Solids

Total Nitrogen (separated to NO_2, $NO_3$3, and Kjeldahl Nitrogen)

Total Phosphorus

Lead

In addition to the above CORE parameters, analysis were made of occasional samples for the following constituents:

COD (Chemical Oxygen Demand)

Fecal Coliform

Total Coliform

Zinc

Cadmium

Copper

Chromium

Mercury

Whether or not any or all of the above identified constituents are pollutants depends upon the definition of pollution and a determination of applicability within the context of that definition. ABAG staff has offered the following definition of pollution:

"Pollution can be defined as the impairment of a desired beneficial use."

The careful application of this definition is and will be of paramount importance in the development and consideration of any surface runoff management plan. For instance, consideration should be given to the substance of the following statement which appears in the report for TASK IV-2 "PRESENT AND PROJECTED WASTE LOADS" (Pg. 116) of the San Francisco Bay Basin Study:

"It should be pointed out that the mere presence of a particular metal does not imply that it will have an adverse effect on the aquatic environment. First, many metals are toxic only in a particular form or forms. The methods generally used to determine metals concentrations in street sweepings or runoff do not distinguish among these forms. These metals are often closely associated with suspended sediments in natural runoff and are not present in solution.

Secondly, considerable amounts of heavy metals can be present in nonurban runoff unaffected by man."

Throughout the remainder of this report all references to "pollutants" and to pollution are made with the above definition and comment in mind.

DEFINITIONS

Biochemical Oxygen Demand (BOD). The amount of oxygen required to allow partial or complete biological oxidation of the organic matter in a given quantity of wastewater. The common measure of BOD of a waste is the quantity of oxygen depletion in a wastewater sample over a five day period; unless otherwise noted, BOD will mean the five-day biochemical oxygen demand.

Nitrogen (N) and Phosphorus (P). The total amounts of these elements in all their chemical forms are included in this definition. Common constituents in wastewaters, nitrogen and phosphorus, are two of the principal nutrients required for biological growth. Due to their stimulatory effect on such growth in waters receiving wastewater discharges, increasing importance and attention is being given to their reduction by treatment prior to discharge. Four forms of nitrogen are of main interest in water quality management. These are ammonia, nitrite, nitrate, and various compounds of organically-bound nitrogen.

WHERE DO POLLUTANTS COME FROM

The two obvious major sources of pollutants in surface runoff are:

1. Natural
2. Man caused

The second, major source of pollutants are the activities of man. These pollutants appear both directly and indirectly. For example, the simple act

of driving an automobile directly produces pollutants by erosion of driving surfaces, the wearing of metalic surfaces, brakelinings, tires all produce pollutants which accumulate along streets and highways. Indirect pollutants are produced by exhaust emissions entering the atmosphere and then appearing in dry fall-out or in rainfall.

Technical Memorandum No. 6 entitled "Rainwater Quality and its Implications on Surface Runoff" produced by ABAG staff for the Environmental Management Program gives some insight to some of the indirect effects of man upon surface runoff:

"Precipitation contains significant amounts of nutrients and pollutants. Some of the constituents commonly found in rainwater are: nutrients (nitrogen, phosphorus, sodium, chloride, and calcium) and pollutants (industrial chemicals, heavy metals, pesticides, and polychlorinated biphenyls).

"Unfortunately, the small amount of regional rainwater quality data in the Bay Area prevents assessment of the extent of the regional problem....much more monitoring is needed to provide an adequate data base for the Bay Area.

1. Pollution sources outside of the Bay Area affect the quality of Bay Area precipitation.
2. There are variations in the concentration of pollutants in precipitation depending on the type of land use that is in the monitoring area.
3. Precipitation contains significant amounts of particulates, nutrients and other pollutants.
4. There seems to be a trend toward acidic conditions for precipitation in the Bay Area.
5. Precipitation is indicated as a source of nutrient loading for surface water and surface water runoff.[11]
6. Precipitation has been found to contain heavy metal pollution.

"7. A combination of air quality data and precipitation data would be necessary to determine the total atmospheric contribution to surface water and surface water runoff."

"The Bay Basin Plan produced by the State Water Resources Control Board[12] indicates that precipitation contributes to the pollutant and nutrient loading of Bay waters. The study attempts to show that an atmospheric pollution problem exists, but little data is available to substantiate their conclusions."

"It is evident that the data base in the Bay Area is not well developed and is lacking in continuity. More work needs to be done before a clear picture of precipitation-related problems emerges for the Bay Area.

G. Summary

"It is known that precipitation-borne pollutant loads and nutrient loads have caused problems in other areas. The amount and effect of precipitation pollution on surface water and surface water runoff have yet to be determined for the Bay Area. Better information on Bay Area bulk precipitation would provide decision-makers with the relative importance of atmospheric pollution to surface water runoff and the Bay Area environment. Therefore, sampling of rainwater quality should be under consideration in the design of future water quality monitoring programs for the San Francisco Bay Area."

[11] Large Lakes Research Unit, Atmospheric Loading Inputs to the Great Lakes System. Gross Ile, Michigan.

[12] SWQCB. Water Quality Control Plan Report, San Francisco Bay Basin (2) 1957.

Table A-1 SOURCES OF POLLUTANTS*

Material	Tot. Vol. Solids mg/g	BOD[a] mg/g	COD mg/g	Grease mg/g	Petroleum mg/g	n-Paraffins mg/g
Gasoline	1000	150	680	1.3	1.3	1.3
Lubricating Grease	970	140		750	670	570
Motor Oil	1000	140	220	990	940	850
Transmission Fluid	1000	100	200	990	940	880
Antifreeze	990	38	1100	140	70	6.1
Undercoating	1000	90	310	960	180	120
Asphalt Pavement	64	1.2	86	21	15	9
Concrete	71	1.4	64	2.7	1.3	1
Rubber	990	27	2000	190	100	56
Diesel Fuel	1000	80	400	390	310	210
Brake Linings	290	17	420	31	8.3	7.6
Brake Fluid	1000	26	2400	880	33	19
Cigarettes	860	85	780	30	21	2.7
Salt[b]	75	-		0	0.0	0.0
Cinders	0.0	-	59	1.3	1.2	1.2
	-	-		-	-	-

Material	Lead	Mercury	Metals Content (ug/g) Cnromium	Copper	Nickel	Zinc
Gasoline	660	0.05	15	4	10	10
Lubricating Grease	2	0.05	2	1	1	160
Motor Oil	9	0.05	2	3	17	1100
Transmission Fluid	5	0.05	2	1	21	240
Antifreeze	6	0.05	2	76	16	14
Undercoating	120	0.05	2	1	480	110
Asphalt Pavement	100	0.05	360	50	1200	160
Concrete	450	0.05	93	99	260	420
Rubber	1100	0.05	180	250	170	620
Diesel Fuel	12	0.05	15	8	8	12
Brake Linings	1100	0.05	2200	31,000	7500	120
Brake Fluid	7	0.05	19	5	31	15
Cigarettes	490	0.05	71	720	190	560
Salt	2	0.05	2	2	9	1
Cinders	2	0.05	2	3	4	7
Area Soil	2	0.05	36	23	25	27
Detection Limit	2	0.05	2	1	1	0.01

* Shaheen, 1975, "Contribution of Urban Usage", EPA 60012-75-004.

a BOD determinations were made on "pure" materials using a seed of unacclimated sewage organisms.

b Results are on a dry weight basis. Salt as received contained 3.7% water, assayed 93.2% sodium chloride, and contained less than 0.005% cyanide.

Table A-1 - "Sources of Pollutants" is a very selective list of the quantities of pollutants contained in a variety of common materials. Not all pollutants are listed and the list of materials is endless; however as an indicator of "Where do the pollutants come from?" this table is a start.

AVAILABLE DATA

Table A-2 identifies the locations of all precipitation stations, streamflow gauging stations, sediment discharge gauging stations, and evaporation gauging stations and period of record within Contra Costa County. This data was compiled by ABAG staff and verified by county personnel.

Examination of a substantial portion of the available historical data led to the following conclusions:

1. Sufficient historical rainfall data exists to reasonably ascertain long term average precipitation within the major watersheds of the county. There are however several locations where additional data would be desirable for more detailed analysis particularly when analyzing specific storm events.

2. Historical and current records of streamflow are generally inadequate for the purpose of ascertaining the quantities of water reaching the Bay-Delta Estuarine System. Most of the stream gauging stations are located well upstream of the stream mouths leaving substantial portions of the watersheds ungauged. Additionally many creeks are ungauged.

3. Water quality monitoring stations for county streams and creeks are virtually non-existent. A relatively small amount of data has been collected for sediment transport and deposition.

TABLE A - 2

DATA SOURCES

MAP CODE	TYPE OF DATA	AGENCY & IDENTIFICATION	PERIOD OF RECORD	LOCATION
S2 - 01	Daily & Peak Discharge	Bureau of Recla No. 11313000 USGS	1951 - present	Delta Mendota Canal @ Tracy
S2 - 02	Daily Discharge	Calif. Dept. of Water Resources	1967 - present	Delta Pumping Plant on Syphon-Tracy
*DS2 - 03	Peak Discharge	Calif. Dept. of Water Resources B95280	1963 - 1969	Italian Slough near Byron
S2 - 04	Peak Discharge	Calif. Dept. of Water Resources B95278	1963 - present	Italian Slough near mouth
S2 - 05	Peak Discharge	Calif. Dept. of Water Resources B95180	1963 - present	Old River near Byron
S2 - 06	Daily Discharge	Calif. Dept. of Water Resources B95180	1945 - present	Old River near Rock slough near Knightsen
S2 - 07	Daily & Peak Discharge	USGS # 357000	1950 - present	Contra Costa Canal near Oakley Calif.
S2 - 08	Daily & Peak Discharge	USGS # 3375	1953 - present	Marsh Cr. near Byron
S2 - 09	Peak Discharge	Bureau of Recla (Int.)	1967 - present	Contra Loma Reser.
S2 - 10	Daily Peak Discharge	USGS # 1830	1952 - present	San Ramon Creek @ Walnut Creek
S2 - 11	Daily & Peak Discharge	USGS # 1836	1968 - present	Walnut Creek @ Concord

* Letter "D" denotes discontinued station

DATA SOURCES

MAP CODE	TYPE OF DATA	AGENCY & IDENTIFICATION	PERIOD OF RECORD	LOCATION
S2 - 12	Daily & Peak Discharge	USGS # 1824	1964 - present	Arroyo Del Hambre @ Martinez
S2 - 13	Daily Discharge	DWR # 44390	1926 - present	Laf. Ck. @ Lafayette Reservoir
S2 - 14	Discharge Frequency	EBMUD # 46412	1924 - present	Redwood Creek @ Upper S.L. Dam
DS2 - 15	Daily Discharge	EBMUD # EA-2600	1941 - 1947	S.P. Ck. Watershed
DS2 - 16	Peak Discharge	USGS # 81450	1958 - 1960	Bear Ck. near Orinda
S2 - 17	Daily & Peak Discharge	USGS # 1821	1938 - present	Pinole Ck. @ Pinole
S2 - 18	Daily Stage	EBMUD # E4-2105	1925 - present	S.P. Ck. @ S.P. Dam
DS2 - 19	Daily Discharge	EBMUD # E4-2105	1927 - 1933	Lower S.P. Ck. @ S.P.
DS2 - 20	Daily Discharge	EBMUD # E4-2105	1917 - 1923	S.P. Ck. @ S.P.
S2 - 21	Daily & Peak Discharge	USGS # 1814	1964 - present	Wildcat Ck. @ Rich.
DS2 - 22	Daily Discharge	EBMUD # E4-2450	1938 - 1947	Bear Creek above S.P. Reservoir
S2 - 23	Daily Stage	EBMUD # E4-2105	1925 - present	S.P. Ck. @ S.P. Dam
DS2 - 24	Daily Discharge	USGS # 85000	1954 - 1960	Grayson Ck. near Hookston
DS2 - 25	Daily Discharge	EBMUD # E4-4325	1965 - 1965	Tice Creek near Castle G. Rd.
DS2 - 26	Daily Discharge	USGS # 84500	1952 - 1960	Pine Ck. @ Concord

DATA SOURCES

MAP CODE	TYPE OF DATA	AGENCY & IDENTIFICATION	PERIOD OF RECORD	LOCATION
DS2 - 27	Daily Discharge	USGS # 83900	1954 - 1956	Galindo Ck. Concord
S2 - 28	Daily Discharge	USGS	1952 - present	San Ramon Ck. @ S.R.
S2 - 29	Daily Stage	CCCFC & WCD	1976 - present	Pine Creek @ Market
DR2 - 01	Climate data		1927 - 1968	Meganos Pump Byron
R2 - 02	Rainfall data	CCCFC & WCD B90-1059-50	1957 - present	Brentwood Corp yard
DR2 - 03	Climate data	US Weather Bureau B90 - 1059	1879 - 1970	Brentwood
R2 - 04	Climate data	US Weather Bureau B80 - 0230	1948 - present	Antioch Pump plant
DR2 - 05	Climate data	US Weather Bureau B90 - 0227	1879 - 1975	Antioch Fibrebd Mill
DR2 - 06	Climate data	US Weather Bureau B80 - 0230	1945 - 1950	South of Antioch
R2 - 08	Rainfall data	SF Water Dist. E50-1597	1912 - present	Cayetano Creek
DR2 - 09	Rainfall data	B80 - 6949	1947 - 1964	Pittsburg Dow Chem.
R2 - 10	Rainfall data	CCCFC & WCD B80-5130-50	1965 - present	Los Medanos Tank
R2 - 11	Rainfall data	E40 - 2073-60	1951 - present	Marsh Ck. Fire Station
DR2 - 12	Rainfall data	SF Water District 8785	1912 - 1959	Tassajara Creek
DR2 - 13	Rainfall data	ACFC & WCD 0068	1912 - 1958	Alamo Creek

DATA SOURCES

MAP CODE	TYPE OF DATA	AGENCY & IDENTIFICATION	PERIOD OF RECORD	LOCATION
R2 - 14	Rainfall data	CCCFC & WCD 8785-50	1952 - present	Tassajara Wood Ranch
R2 - 15	Climate data	US Weather Bureau E40-5916	1956 - present	Mt. Diablo SPHDQ
R2 - 16	Climate data	US Weather Bureau 5915	1952 - present	Mt. Diablo N. Gate
DR2 - 17	Climate data	US Weather Bureau E40-1786	1956 - 1958	Clayton ISW
DR2 - 18	Climate data	US Weather Bureau E40 - 9427	1954 - 1976	Walnut Creek 4E
DR2 - 19	Rainfall data	CCCFC & WCD	1952 - 1957	Diablo Golf Course
DR2 - 20	Rainfall data	2428	1931 - 1939	Diablo Post Office
R2 - 21	Rainfall data	CCCFC & WCD	1973 - present	Dublin Fire Station
DR2 - 22	Rainfall data	ACFC & WCD E50-9502	1954 - 1973	Weidemann Ranch
R2 - 23	Rainfall data	ACFC & WCD E40-0954-04	1952 - present	Bolinas Canyon
DR2 - 24	Rainfall data	ACFC & WCD E40-2213-50	1944 - 1967	Cull Canyon
DR2 - 25	Rainfall data	EBMUD 0957 - 11	1944 - 1946	Bollinger Canyon
R2 - 26	Rainfall data	CCCFC & WCD	1969 - present	Orr Del Amigo
DR2 - 27	Climate data	US Weather Bureau 5000	1956 - 1957	Livorna
DR2 - 28	Climate data	US Weather Bureau 0064	1958 - 1975	Alamo 1N
DR2 - 29	Climate data	US Weather Bureau E40 - 9423	1887 - 1974	Walnut Creek 2ESE

DATA SOURCES

MAP CODE	TYPE OF DATA	AGENCY & IDENTIFICATION	PERIOD OF RECORD	LOCATION
R2 - 30	Rainfall data	CCCFC & WCD E40-9423-04	1956 - present	Walnut Creek 2S
R2 - 31	Climate data	US Weather Bureau E40-9426	1944 - present	Walnut Creek 2ENE
DR2 - 32	Rainfall data	CCCFC & WCD E40-6313	1954 - 1964	Oak Grove School
DR2 - 33	Climate data	US Weather Bureau E40-1786	1956 - 1958	Concord 3E
R2 - 34	Climate data	US Weather Bureau E40-1959	1953 - present	Concord
DR2 - 35	Rainfall data	CCCFC & WCD E40-1150	1952 - 1971	Buchanan Field
R2 - 36	Rainfall data	CCCFC & WCD E40-1695	1931 - present	Chenery Filter Plant
DR2 - 37	Rainfall data	CCCFC & WCD E40-7991	1955 - 1960	Saranap
R2 - 38	Rainfall data	CCCFC & WCD E40-5371-50	1969 - present	Martinez FCD
DR2 - 39	Climate data	US Weather Bureau E40-5372	1956 - 1975	Martinez 3SS E
R2 - 40	Climate data	US Weather Bureau E40-3841	1956 - present	Haverside Ranch
R2 - 41	Climate data	US Weather Bur. E40-6982	1956 - present	Pleasant Hill Inn
DR2 - 42	Climate data	US Weather Bur. E40-9420	1956 - 1973	Wilmar School
DR2 - 43	Rainfall data	CCCFC & WCD E40-3665-50	1960 - 1964	Grove & Pleasant Hill
DR2 - 44	Rainfall data	EBMUD E40-9423-01	1936 - 1971	W.C. Pump Plant
DR2 - 45	Climate data	US Weather Bur. E40-0633	1956 - 1976	Lafayette 2ENE
R2 - 46	Rainfall data	EBMUD E40-9424-50	1967 - present	W.C. Filter Plant

DATA SOURCES

MAP CODE	TYPE OF DATA	AGENCY & IDENTIFICATION	PERIOD OF RECORD	LOCATION
R2 - 47	Rainfall data	CCCFC & WCD E40-1249-50	1966 - present	Bryan & Murphy WC
DR2 - 48	Rainfall data	CCCFC & WCD E40-4636-01	1951 - 1958	Lafayette Oaks
DR2 - 49	Rainfall data	CCCFC & WCD E40-4635	1956 - 1958	Lafayette Fire Sta.
R2 - 50	Rainfall data	EBMUD E40-4637	1924 - present	Lafayette Reservoir
DR2 - 51	Rainfall data	CCCFC & WCD E40-4635-50	1959 - 1968	Lafayette Fire
R2 - 52	Rainfall data	CCCFC & WCD E40-2278	1954 - present	Danville Co. yard
R2 - 53	Rainfall data	CCCFC & WCD E40 - 7661	1942 - present	St. Marys College
R2 - 54	Rainfall data	CCCFC & WCD 5838 - 11	1952 - present	Moraga Station
R2 - 55	Rainfall data	EBMUD 8273	1944 - 1947	Skyline Gate
R2 - 56	Rainfall data	EBMUD 9185 - 03	1923 - present	Upper S.L. Reservoir
DR2 - 57	Climate data	US Weather Bur. E40-6332	1873 - 1958	Oakland
DR2 - 58	Climate data	US Weather Bur. E40-6336-40		Oak. Rishell Drive
DR2 - 59	Climate data	US Weather Bur. 3652	1940 - 1960	Grizzly Peak
DR2 - 60	Climate data	US Weather Bur. 1216	1956 - 1975	Burton Ranch
R2 - 61	Rainfall data	EBMUD E40-7872-12	1922 - present	San Pablo Patrol House
R2 - 62	Climate data	US Weather Bur. E40-5371	1941 - present	Martinez 3S
DR2 - 63	Climate data	US Weather Bur. E40-5377	1938 - 1969	Martinez Fire Station
R2 - 64	Rainfall data	CCCFC & WCD E40-5371-40	1961 - present	Martinez Corp. yard

DATA SOURCES

MAP CODE	TYPE OF DATA	AGENCY & IDENTIFICATION	PERIOD OF RECORD	LOCATION
R2 - 65	Climate data	US Weather Bur. E40-2177	1918 - present	Crockett
DR2 - 66	Climate data	State Climatologist E40-6931	1938 - 1963	Pinole Creek G.S.
R2 - 67	Rainfall data	EBMUD	1971 - present	Sobrante Filters
R2 - 68	Rainfall data	CCCFC & WCD	1953 - present	Richmond Corp. yard
R2 - 69	Rainfall data	CCCFC & WCD	1950 - present	Richmond City Hall
R2 - 70	Rainfall data	EBMUD E40-9185-03	1949 - present	Upper San Leandro Dam
R2 - 71	Rainfall data	CCCFC & WCD E40-8188	1965 - present	Shore Acres Treatment Plant

The acquisition of data for the purposes of this study concentrated on three segments:

1. Statistical Data
    a. Rainfall
    b. Streamflow
2. Past Studies
3. Problem Identification

STATISTICAL DATA

The statistical rainfall data utilized for this study consisted of the monthly, annual and long term average precipitation records for the Walnut Creek 2 ENE U.S. Weather Service Station and the Mean Seasonal Isohyets for the entire county compiled and prepared by the Contra Costa County Flood Control and Water Conservation District from precipitation records covering the period 1879 to 1973.

Streamflow records utilized were those published annually by the U.S. Geological Survey - "Water Resources Data for California, Part I, Surface Water Records." Records for the period of 1968 to 1975 were compiled as available for each of the currently operated stream gauge stations within the county. Table A-3 is a summary of the data utilized.

A search was made for streamflow water quality records with generally negative results. The only known water quality monitoring program was that conducted by the City of Concord on Walnut Creek as a part of its self-monitoring program in connection with the discharge of treated sewage effluent from the city's wastewater treatment facility into Walnut Creek just upstream of the confluence of Walnut and Pine Creeks. Under the self-monitoring

program the city was required to sample creek waters upstream of its discharge on a monthly basis. As of December 1976 the city ceased discharging at this location and terminated this element of their program. Table A-4 is a tabulation of results of the water analysis made for the city's self-monitoring program.

Examination of the City of Concord's monitoring data leads to the following conclusions:

1. The dissolved oxygen (DO) level in Walnut Creek is satisfactory even under low flow conditions. (Above 5.0 mg/1)

2. The pH range is within tolerable limits. (Between 6.5 and 8.5)

3. The coliform count is consistently high to prevent the use of these waters for body contact purposes. (Above an MPN of 200/100 ml.)

4. Insufficient data is available to formulate conclusions relative to other water quality parameters or to water quality characteristics prevailing under moderate or high flow conditions.

TABLE A-3

ANNUAL STREAM DISCHARGE DATA

STREAM/GAGE LOCATION	DRAINAGE AREA (Square Miles) (Acres)	DESCRIPTION OF DRAINAGE AREA	PERIOD OF RECORD	AVERAGE ANNUAL DISCHARGE (Acre Feet)	AVERAGE ANNUAL BASE FLOW (Acre Feet)	AVERAGE ANNUAL SURFACE RUNOFF (Acre Feet)
Marsh Creek / 1.2 miles upstream from Marsh Creek Dam	42.6 27264	All open space - moderate to rugged hills	Feb. 1953 to present	6,200	2,500	3,620
Walnut Creek / 0.3 miles upstream from Monument Blvd. Bridge	85.1 54464	75% open space - terrain varies from flat valleys to steep hills	Oct. 1968 to present	34,850	11,030	24,820
Arroyo Del Hombre / at "D" Street Bridge, Martinez	15.1 9664	80% open space - gently sloping valleys to moderate hills	Oct. 1964 to present	3,270	1,350	1,920
Wildcat Creek / 2 miles upstream of outlet to San Pablo Bay	8.69 3568	67% open space - narrow, gently sloping valleys to moderate hills	July 1964 to present	3,890	1,020	3,870
Rheem Creek / 0.7 mile upstream of outlet to San Pablo Bay	1.09 704	All developed	Dec. 1960 to present	1,040	260	780
Pinole Creek / 0.2 mile downstream of bridge on Pinole Valley Rd. west of intersection with Castro Road	10.0 6400	All open space - narrow sloping valleys to moderate hills	Dec. 1938 to present	2,830	1,190	1,640
San Ramon Creek / at Rudgear Rd., Walnut Creek	47.9 30656	85% open space - gently sloping valleys, moderate to rugged hills	Oct. 1952 to present	11,740	2,820	8,920
San Ramon Creek / 0.2 mile downstream of Bolinger Cr.	5.89 3770	All open space, moderate hills, narrow sloping valleys	Oct. 1952 to present	2,160	Not determined	

TABLE A-4

RESULTS FROM CITY OF CONCORD'S SELF-MONITORING PROGRAM FOR WASTEWATER DISCHARGE INTO WALNUT CREEK (1)

Date	Flow in Walnut Creek (cfs)	Dissolved Oxygen (mg/l)	Temp (°C)	pH	Total Coliforms (MPN/100 ml)	NH_4 (mg/l)	NO_2 (mg/l)	NO_3 (mg/l)	TKN (mg/l)	P (mg/l)
12-12-74	11	10.6	8	7.8	2,400	3.2	.023	.10	3.6	1.5
1-20-75	12	16.8	12	8.5	23,000					
2-24-75	21	12.5	9	8.1	620					
3-21-75	1370	11.2	10.5	8.2	24,000	22.7	.006	.02	25.6	8.8
4-23-75	36	12.0	13	7.6	24,000					
5-14-75	22	13.0	13	---	9,300					
6-20-75	14	12.8	20	7.9	11,000					
7-16-75	16	12.0	21	7.8	11,000					
8-18-75	15	11.5	19	7.7	11,000					
9-5-75	11	13.2	25	8.1	24,000					
10-21-75	9	11.0	17	7.6	2,400					
11-17-75	9	13.8	12	7.9	7,000					
12-9-75	9	13.6	12	7.7	24,000					
1-13-76	9	17.0	12	7.9	24,000					
2-10-76	9	13.0	13	8.2	7,000					
3-24-76	10	15.0	17	8.1	24,000					
4-22-76	7	8.2	17	7.9	24,000					
5-4-76	9	10.0	19	7.7	24,000					
6-8-76	9	10.0	19	7.7	24,000					
7-28-76	8	9.8	20	7.5	24,000					
8-4-76	8	10.0	20	7.6	24,000					
9-1-76	7	9.8	21	7.6	24,000					
10-8-76		10.4	18	7.6	24,000					
11-4-76		9.8	15	7.9	24,000					
12-7-76		10.0	15	7.9	24,000					

(1) Tests taken 100 feet upstream of discharge

PAST STUDIES

Further insight as to the significance of surface runoff as a water quality problem was gained by conducting a survey and review of past county studies and reports dealing wholly or in part with water quality. Table A-5 is a partial listing of the reports reviewed with comments appended.

Several findings and conclusions have been drawn on the basis of this survey and review:

1. Three studies were found dealing specifically with water quality of characteristics streamflow within Contra Costa County:

   a. Sediment Transport and Deposition in Walnut and Pacheco Creeks - USGS 1970.

   b. Las Trampas Creek Study - M. Fisher, 1975.

   c. Hydrologic and Water Quality Studies - Arroyo Del Cerro Project - CCCFC & WCD, 1975.

2. A number of EIR's mention the probable degradation of water quality by surface runoff from a project area, however no analysis is provided nor any mitigation measures proposed.

3. Although investigations of sediment transport have been conducted for a number of county streams, insufficient data is available to determine the quantity of sediments ultimately reaching Bay-Delta waters on a county-wide basis. (Marsh Creek 1970-71, Arroyo de Hambre 1970-71, Walnut Creek @ Walnut Creek 1957-62, Walnut Creek @ Concord 1970-71)

4. Knowledge regarding the quality of water in the county's streams and creeks can best be described as meager.

PROBLEM IDENTIFICATION

The third element of data acquisition involved the identification of local problems associated with storm water runoff. Each city was contacted

TABLE A - 5

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
Hyde, C.G.	Report on Storm Water & Sewage Flow from Pt. Richmond	1910	Bay adjacent to Richmond	Amount of pollutants discharged into Bay	Detrimental effect of waste water discharge into bay cannot be ascertained. Living organisms exist in vicinity of discharge point.
E.C.C.I.D.	Ground water survey	1937	East Contra Costa Irrigation District	Investigate results of pumping on water table.	Quality of ground water depend on soil in areas & location of septic tanks.
Carpenter, E.J.	Soil Survey of County	1939	Contra Costa County	Type of soils in County	Useful for erosion protection requirements & agric. purposes.
Dept. of Fish and Game	A survey of effects of pollution upon aquatic life in the Castro Creek area of San Pablo Bay	1952	Outfall from Standard Oil refinery in San Pablo Bay	Survey for effect of discharge of wastes	Max. degradation with no living organisms 500-1000 yds. from shore. Zone of recovery-strip 500 yds. Wide healthy zone outside this strip.
County FC & WC District	Walnut Creek Watershed program for soil conser. & flood control	1952	Walnut Creek Pine Creek Grayson Creek in W.C. area	To improve flood protection and soil conser.	Discusses why creeks flood and proposed meas. to curb flooding.
Dept. of Public Health	Richmond Discharge investigation	1953	Richmond discharge line in bay	Is industrial waste water & sewer outfall harmful to aquatic life in bay	Detrimental pollution of bay not confirmed from samples taken in vicinity of discharge line

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
County F.C. & W.C. Dist.	Marsh Creek & Kellogg Creek Watershed program	1953 1959	Marsh Creek & Kellogg Creek	Soil Conservation Methods	Report provides basic information to control floods & damage from runoff erosion & sedimentation.
County F.C. & W.C. Dist	Engineer's report on proposed flood control improv. for Zone 3B	1954	Walnut Creek Watershed	Reduce damage caused by flooding	Discusses improvements to prevent flooding of creeks.
Zollner, K.	Report on Contra Costa Canal	1960	Contra Costa Canal	Report of Sanitary Engr. Survey of Public water system by State of Calif. Dept. of Public Health	Discusses ownership of Canal, major sources of pollution, waste dumped in slough, livestock & surface runoff of irrigation waters.
Brown & Caldwell	Monitoring Study of water conditions	1960	Suisun Bay	Water Quality study for Sanitary District	The report discusses results of 8 sampling runs for extent of pollution in Bay prior direct discharge from treatment plant. No conclusion formulated.
Brown & Caldwell	Project report for water reclamation plant	1961	Orinda, Moraga, Walnut Creek, Martinez and Mt. View San. District	A report for enlargement of modification of Dist. waste water treatment plant.	Report contains maps, diagrams, plans, tables for design of plant.

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
Crouse, R.	First year effects of land treatment on dry season stream flow after a fire	1961	Contra Costa County	Investigate various methods of treatment of land denuded by fire	Treated land with new growth retains surface runoff.
Eliassen, R.	Industrial benefits derived from improved raw water quality in Contra Costa Canal	1962	Contra Costa Canal	Raw water quality in Contra Costa Canal	Poor quality water in canal cause economic penalties which are national in scope. Costs vary to treat water depending on quality of water.
U.S. Public Health	An evaluation of economic benefits derived from improved water quality in C.C. Canal	1963	Contra Costa Canal	To improve quality of water in canal	Discusses industry use of water. Good quality water reduces costs. Benefit/cost ratio discussed.
Knapp, H.C.	Status of water pollution control in Contra Costa County	1963	Suisun Bay	A report on major violators pollut-ing bay	Discusses major discharge points & firms that are in violation.
Metcalf & Eddy	Study of effects of proposed Federal San Luis interceptor drain and State San Joaquin Valley master drain.	1964	Western Delta	As indicated by title	Concludes that discharge of drainage will be harmful.

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
U.S. Dept. Interior	Sediment transport and deposition Walnut and Pacheco Creeks	8/65 4/70	Walnut and Pacheco Creeks C.C.C.	Sediment Survey	The report discusses the amounts of sediment deposited in the creeks. Amount is greater than calculated.
Metcalf & Eddy	An economic evaluation of the water quality aspects at county offshore water supply	1965	Contra Costa County	To reduce to cost frame of reference benefits or detriment to county economy by changing quality of offshore water now & in the future	Report discusses crop yields vs. salinity water quality, recreation, barriers & ground water.
U.S. Bureau of Reclamation	Water for Contra Costa from Central Valley Project	1965	Contra Costa County	Will additional water from CVP protect industries and agriculture	Additional water will lower salinity of canal & benefit industries & agriculture.
U.S. Army Corp.	West Contra Costa sanitary land fill		Richmond sanitary land fill in Bay Area	Draft EIR	Discusses dikes & embankments req'd to contain dumped fill material
Medcalf & Eddy	The effect of BOD on the oxygen resources of offshore waters of county	1966	Suisun Bay	Test water for 30 days for BOD in summer & winter	Rate of nitrification increases with higher water temperature & reduction of fresh water outflow.

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
U.S. Dept. of Interior - Geological Survey	Water Resources data for Calif. Surface water records part 1 & 2	1967 - 1975	San Ramon Creek Walnut Creek Alhambra Creek Pinole Creek Rheem Creek Wildcat Creek Marsh Creek, etc.	Stream flow records by day & month	Combined base flow with surface flow. Flow on a daily basis.
Tarp, Fred	Ecological effects of Fed-State water planning on Delta Fisheries	1967	Delta	To examine the potential effects of water projects upon fisheries	Concludes that damage is occurring and will worsen. More study is required to develop protective measures.
Uniconsult	A study regarding waste water collection, treatment & disposal for Western Contra Costa County	1967	Western Contra Costa County	Reviews existing wastewater treatment & disposal facilities	Discusses long range plans for joint treatment and disposal facilities for various areas in C.C.C. sets standards & estimates costs.
Welch, L.	Contra Costa County Soil Survey	1968	Contra Costa County	Describes types of soil in County	Aid for farmers on crop planting. Also discusses erodible soils and methods to prevent erosion.
Rowland, W.F.	The Contra Costa Canal Project	1968	Contra Costa Canal	Thesis	Discusses quality of water in canal and industrial use of water.
CCCFC & WCD	Work plan upper Pine Creek Watershed	2/69	Upper Pine Creek C.C.C.	Eliminate flooding, control erosion. Reduce sediment damage.	The report discusses the work & costs involved in the plan.

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
Bechtel Corp.	Investigation of water renovation in central Contra Costa County	1969	Central Contra Costa County	Feasibility of water reclamation	Concludes that reclamation is feasible.
Contra Costa County Water District	The Delta: Source of supply	1969	Delta	Water quality in Contra Costa Canal	Fresh water release required to maintain quality water.
Jones & Stokes	EIR Central C.C. San. Dist. Water Reclamation Plant	1971	Central San. waste water treatment plant	EIR	The report describes the nature of the area served by plant & both beneficial & potentially detrimental impact of addition.
Brown & Caldwell	Contra Costa County Water Quality Study	1972	Contra Costa County	Investigation of need for & feasibility of sub-regional waste water treatment facilities	Established foundation for three sub-regional facilities and timetables.
Horstkotte, G.	Pilot demonstration for industrial reuse of renovated municipal waste water	1973	Central San treatment Plant Contra Costa County	Study to determine if waste water can be used in industrial applications.	3 pilot plants used in tests. Precipitation of phosphorous major source of scale formations. Discusses ways & costs of treat water.
Blake, M.	Geologic Map of Alameda, Contra Costa and Sonoma	1974	Alameda, Contra Costa & Sonoma Co.	To classify various land formations found in County	Locates arid areas suitable only for grazing and with a high degree of erodibility. Classifies soils for their greatest use.

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
U.S. Dept. Ag. Soil Conser. Service	Soil survey of Contra Costa County	9/74	Contra Costa County	Identify soils in County	Classifies soils & erodibility characteristics
U.S. Army Corp.	Suisun Bay area maintenance dredging	1974	Suisun Bay/San Pablo Bay and channels	Shipping channels required for passage of large ships EIR	Report discusses maintenance dredging & depths & widths maintained. Also discusses fish in Bay & wildlife in marsh.
U.S. Army Corp.	Draft EIR Walnut Creek Project	1975	Walnut Creek Grayson Creek Pine Creek Galindo Creek San Ramon Creek Las Trampas Creek	EIR	Discusses past, present & future construction work in creeks.
McBride, J.R.	Urbanization & Stream flow in Berkeley Hills	1975	Berkeley Hills	What effect urbanizing has on stream flow.	The greater the urbanization the higher the runoff
U.S. Environ. Prot. Agency	Waste water management program	2/76	Western C.C.C.	EIS	Examine proposed consolidation of treatment plants and outfalls.
U.S. Environ. Prot. Agency	Waste water management program	8/76	Central C.C.C.	EIS	Examine proposed expansion & upgrading of Central San. Treatment facility

SUMMARY OF PAST STUDIES REVIEWED
(Including those which contained no relevant data)

AUTHOR OR AGENCY	TITLE	DATE	AREA COVERED BY STUDY	PURPOSE OF STUDY	COMMENTS
U.S. Environ. Prot. Agency	Waste water management program	1/77	East/Central C.C.C.	EIS	Examine proposed consolidation of treatment plants & outfalls
Fisher, M.	Las Trampas Creek	11/75	1.5 miles d/s St. Marys Rd. to 2.5 miles u/s St. Marys Rd.	Determine pollutant concentrations as class project	High pollutant level in Bollinger Canyon portion of stream. Levels highest after rainfall. Pollutants wash into creek.
CCCFC & WCD (by WRE)	Hydrologic and Water Quality Studies - Arroyo Del Cerro Project	5/75	Upper portion of Pine Creek Watershed	Development of reservoir operations program and water quality management strategy	High nutrient concentrations in inflow will require corrective measures
EBMUD	The Sources of Coliforms in San Pablo Creek and proposed control measures	1977	San Pablo Creek watershed above San Pablo Reservoir	Determine sources of coliform contributions to San Pablo Creek and to develop control measures	Problem has existed for many years and has been dealt with by chlorination. DF & G resists continuation of this solution

through both the City Managers Group and the City-County Engineers Committee. In addition, contacts were made with County Health Department, Contra Costa County Water District, East Bay Municipal Utility District, and the County's Public Participation Committee. In all three, specific local problems were identified:

1. Surface runoff entering the Contra Costa Canal. The Contra Costa County Water District has prepared the following description of this local problem:

DRAINAGE INTO CONTRA COSTA CANAL

(ABAG 208 STUDY)

"Urbanization is occurring at a rapid pace in Central and Eastern Contra Costa County served by the Contra Costa Canal System. Prior to this urbanization, Canal water was used primarily for irrigation. Storm runoff transported in the Canal was not cause for concern to irrigators in the early years.

"Municipalities and industries have replaced irrigators as the major users of Canal water. Consequently, transporting storm runoff in the Canal has become undesirable because of the pollutional load carried by surface runoff into the system.

"Topography on both sides of the Canal is such that storm runoff from adjacent lands readily enters the Canal. The four-mile intake-channel of the Canal is bordered by agricultural and grazing land. Then the Canal flows through a section of orchards beyond which the land bordering the Canal varies from urbanized areas to orchards.

"Water delivery to the Canal is from Rock Slough in the Delta. Delta sloughs are leveed to permit agriculture in the Islands of the Delta. The depth to ground water surface in the islands is very close to ground level. Agricultural return flows and storm drainage water are collected in a system of ditches and dumped or pumped periodically over the levees into the sloughs, increasing the potential for pollution in Contra Costa Canal.

"From Rock Sough to the City of Martinez, land surface runoff, including wastes from corrals, drainage from storm drain culverts, and street run-off enter the Canal, either by sheet-flow or through storm drainage pipes which were installed at specific locations during Canal construction to prevent damage to the concrete lining of the Canal. There are approximately 340 discharge pipes into the Canal for this purpose. In addition, runoff from some urban areas terminate in the Canal at various locations. Among these are drains which collect runoff into the two 3' X 1' concrete drains at Milepost 16.48, west of Railroad Avenue, in Pittsburg. So also are the Wren Avenue drains, particularly the 8-inch and 12-inch pipes located at Milepost 31.75 and the 12-inch pipe at M.P. 31.74 which collect drainage from Wren Avenue School. Finally, there are the large drains near Ygnacio High School, in particular the three 15-inch drains with flap gates located at Mileposts 36.09, 36.50 and 37.03, and the 24-inch concrete drain with flap gate at Milepost 37.50. These drainage inlets contribute to poor water quality in the Contra Costa Canal System."

2. <u>The quality of San Pablo Creek waters entering EBMUD's San Pablo Reservoir.</u> EBMUD has been studying this problem however no specific solu-

tion(s) have been finalized. The following is excerpted from EBMUD's pending draft report on this subject:

"INTRODUCTION

"Purpose

Coliform contamination of San Pablo Creek has been documented since the 1930's. Total coliform counts have continued to be high (since 1961, an average of greater than 7000 MPN/100 ml) immediately upstream of the Orinda Filter Plant. Although previous studies have attempted to explain the sources of coliforms in San Pablo Creek, none have actually traced these sources analytically. Consequently, a sampling program was conducted from August, 1976, to April, 1977, to identify the sources of coliform contamination in San Pablo Creek. The purpose of this report is to define more specifically the sources of the coliforms in San Pablo Creek and their significance as a threat to public health, and to propose control actions to be taken by the District.

"Background

San Pablo Creek, prior to entering San Pablo Reservoir, extends about five miles through Orinda and drains a residential, commercial, and agricultural watershed. See Figures 1 and 2. The East Bay Municipal Utility District owns most of the watershed adjacent to the reservoir and up to approximately one mile upstream of the reservoir. Situated at the upstream boundary, the Orinda Filter Plant has been monitoring San Pablo Creek for total coliform since the 1920's.

"Since the 1930's, the waters of San Pablo Creek entering San Pablo Reservoir have consistently been shown to contain a high level of bacterial contamination. As a result, the District began chlorinating San Pablo Creek in October, 1931, to reduce the coliform levels entering San Pablo Reservoir. In keeping with recommended water sanitation practices as set forth by the U.S. Public Health Service (1946), allowance of significantly contaminated inputs into municipal drinking water would be deemed as a dubious and possibly negligent practice.

"Before recreation was allowed at San Pablo Reservoir, the reservoir's sole function was to store raw water prior to treatment for the production of a safe, potable drinking water supply. Above all other considerations in the use of the reservoir, the protection of public health will always be the primary concern. In adherence to this philosophy, the principle of multiple barriers, as discussed by Phelps (1944), or the attainment of the highest bacterial quality possible in every step of water supply must be followed. The principle of multiple barriers realizes the fallibility of human and mechanized performance and calls for adequate safeguards in the water supply so that malfunction of any one operation would not jeopardize public health. One of these steps includes the maintenance of the highest quality water possible in raw water terminal reservoirs such as San Pablo Reservoir. Here, safeguards can only be secured by receiving supplies which have been adequately protected from contamination.

"To reduce the coliforms entering the reservoir, numerous restrictions have been imposed upon land usage along shoreline lots. Cattle were fenced off from coming within 100 feet of the shoreline, birds (cliff swallows) were discouraged from nesting on the intake towers,

public access was prohibited, and 25 to 100 pounds of supplemental chlorine per day were added to San Pablo Creek to reduce the extremely high coliform levels.

"When the San Pablo Recreation area was opened to the public in July of 1973, San Pablo Reservoir was deemed to serve more functions. Fishing and boating commenced, and since this involved public use, governmental interest and involvement in the reservoir's management increased. In 1974, San Pablo Creek above the reservoir was included in the jurisdiction of "Waters of the United States." This interpretation was prompted by EPA's issuance of NPDES permits. From EPA's interpretation, the Regional Water Quality Control Board (RWQCB) assumed responsibility for the regulation of discharges from the Orinda Filter Plant. Gradually, the District's main function as a water supplier concerned with protecting the public health was being clouded by the multiplicity of uses and regulations.

"At the same time, the California Department of Fish and Game started to cooperate with EBMUD and the East Bay Regional Park District to establish a recreational fisheries management program. San Pablo Reservoir is a warm-water lake and naturally supports warm-water fish such as blue gill, catfish, carp, suckers, crappies, and a limited population of base. To make San Pablo Reservoir recreationally desirable, catchable-sized, hatchery-raised trout must be planted periodically. Apparently in the search for natural spawning streams, Fish and Game officials surveyed San Pablo Creek above the reservoir in 1974 and 1976. They felt that the creek had spawning possibilities, but objected to the chlorination of the creek because of its deleterious effect upon fish, especially trout.

"The spawning potential of San Pablo Creek is limited by a 10-12 foot dam near Bear Creek Road approximately one-third of a mile upstream of the reservoir. Spawning of trout in San Pablo Creek would only reduce present quantities planted by approximately 10 percent. Spawining of trout in San Pablo Creek would, however, increase the forage fishery by drawing forage fish out into the open waters of the reservoir to feed on the young trout. The total number of carp in the reservoir could also be regulated by electro-shocking the fish in the creek during their spawing season which is prior to the trout spawning season.

"Public Health Debate

The extent to which public health may be threatened is most often a matter of opinion, and the case involving San Pablo Creek is no exception. Mr. Morgan Stewart, Supervising Sanitary Engineer, Region I, California State Department of Health, in a memorandum of May 17, 1976, to Mr. Larry Kolb, Requirements Section Leader, California Regional Water Quality Control Board, San Francisco Bay Region, stated that the chlorination of the creek waters "seems to be untenable from an environmental viewpoint" since most of the development of the watershed has been sewered. Mr. Stewart went on to state that if the high levels of total coliforms "are due to overflowing septic tanks on the watershed or to gross animal pollution, adequate sources control should be provided to eliminate these discharges." (See Appendix A.) On the other hand, Mr. Henry Ongerth, State Sanitary Engineer, California State Department of Health, in a letter of June 2, 1976, to Mr. D. G. Larkin, Assistant General Manager and Chief Engineer, East Bay Municipal Utility District, assuming that the high coliform levels in the creek were largely attri-

butable to the septic tanks still in use on the watershed, stated that "major and prompt efforts should be made to eliminate the septic tank hazard to the quality of water in San Pablo Creek." In the interim, Mr. Ongerth supported "the District's position to reduce coliform contribution by the creek to San Pablo Reservoir by chlorinating the creek flow." (See Appendix B.)

"The District considers a policy that allows a known supply of contaminated water to enter what ultimately will be a municipal drinking water supply to be dubious and negligent. The District realizes that the sources of coliform may be diversified and time-varying. This study hopes to identify these sources and assess their significance on public health.

"Health Hazards

Health hazards posed by allowing contamination to enter San Pablo Reservoir now involve recreational uses as well as drinking water. If the Orinda Filter Plant were to cease all chlorine discharges to the creek, public health hazards would be expected to increase for the following uses:

1. The total coliform levels of San Pablo Reservoir, presently fairly low, would be expected to increase. This would be especially critical during rainy months when large volumes of contaminated water would reach the unstratified reservoir and quickly reach the outlet towers prior to treatment at the San Pablo and Sobrante Filter Plants.

2. Activities involving frequent hand contact with the lake water such as boating and fishing, may be endangered by the

contaminated water in the inlet area of the lake.

3. Geldreich (1970) has documented that freshwater fish may become active carriers of human pathogens for periods up to 7 days after exposure to contaminated water. During this time, they may introduce potential pathogens to clean water areas.

4. Children trespassing on the District's land have been seen swimming in large pools in the creek next to the filter plant. Public access to these pools seems to be from an upstream entrance not under the District's control.

"Since the primary and intended uses are the reason for the existence of the reservoir itself, and may be threatened by public health risks, allowing contaminated water to flow unaltered into a municipal water supply and recreational facility, could be considered a negligent and dubious practice. Therefore, some means to reduce the input of pathogens in San Pablo Creek has been necessary.

"Although the District is concerned with all types of coliform, since they indicate possible contamination, certain potential pathogens may be more resistant to die-off in the surface water. Nematodes, especially in the egg stage, are resistant to the harshest environments and have been seen to be more concentrated in drainage from urban areas than rural. Surveys have shown that nematodes were fairly common in treated municipal water from surface sources. Chonduri (1964) has demonstrated that nematodes, by ingesting pathogenic bacteria or viruses, could protect them from disinfection in the treatment plant. Thus the presence of nematodes in the raw water supply ought to be kept to a minimum.

"The survival of pathogenic viruses in water is not too well known, but Beard (1965) has presented evidence that under proper conditions,

one virus particle is enough to start infection in a single cell. Therefore, depending upon the host defense mechanisms, one virus particle may constitute a minimal infectious dose. An infection may not manifest itself in clinical symptoms, but an infected host is a carrier of the virus. Berk (1970) and Cookson (1974) have stressed that water should be virus free.

To remove viruses to such a standard requires a raw water supply within the range of treatment processes. With more research on the role of viruses, as agents in cancer and other diseases, future drinking water standards may bring such requirements to bear.

3. Sediment transport and deposition. Sediment transport and deposition is known to occur in all moving bodies of water as a natural phenomenon. Activities of man tend to increase the quantities of sediment available for transport and deposition by increasing the area of erodable surfaces. Sediment deposition is usually considered a maintenance problem. Excessive localized sediment deposition can smother bottom life and diminish streamflow carrying capacities and/or reservoir holding capacities. Sediments do absorb heavy metals from the water column thereby diminishing their potential deleterious effects upon the ecosystem.

In addition the following general problems have been or can be observed on an intermittent basis:

1. Presence of oil and grease.
2. Presence of debris and litter.
3. Overflows of sanitary sewers.
4. Occasional, intentional and/or accidental discharge of hazardous materials into storm drain systems and/or creeks.

Based upon the limited water quality monitoring for total and fecal coliform counts, it appears probable that all surface runoff can be classified as having some degree of bacterial contamination. The Bay Basin Plan sets forth as a water quality objective for bacteria in nontidal waters designated for noncontact recreation that the average fecal coliform concentration for any 30 day period shall not exceed 2000/100 ml and that for nontidal waters designated for contact recreation the fecal coliform concentration for any 30 day period shall not exceed a log mean of 200/100 ml. Out of 14 samples none met the limit for contact recreation and only 4 met the limit for non-contact recreation.

REGIONAL PROBLEMS

The effects of stormwater runoff upon the Bay-Delta Estuarine System has been identified in the ABAG Work Plan for the Environmental Management Plan as a problem of regional significance hence will be examined in the preparation of the Regional Surface Runoff Management Plan. One of the major objectives of this study was to develop an understanding of the magnitude of both quantity and quality of stormwater runoff loadings upon the Bay-Delta system.

DATA ACQUISITION

Two data acquisition programs were utilized in the study to assist in answering the questions of what constituents are contained in surface runoff and in what quantities. The first being a water quality monitoring program, the second being a mathematical modeling program.

THE WATER QUALITY MONITORING PROGRAM

The primary purpose of the monitoring program was to examine a prescribed list of constituents of stormwater runoff from Contra Costa County to determine if any unusual water quality characterists exist as compared to national averages.

It was the desire of EPA that the expenditure of funds and effort on this element be kept at a minimum. As a result a program was devised that concentrated on the collection and analysis of samples within the watershed contributing greatest percentage of discharge to the Bay-Delta - that being the Walnut Creek watershed. It was also proposed that one runoff event be monitored at one station in western and two stations in eastern Contra Costa County.

The lack of significant rainfall events required some modification of the planned monitoring program. Specifically the monitoring of Marsh Creek at two locations was deleted due to insufficient runoff. Instead several random samples from various additional streams within the Walnut Creek watershed were collected and analyzed.

Figure A-1 shows the locations of the monitoring stations and MAC watersheds.

Table A-6 is a summary of the test results for core parameters (e.g. Biochemical Oxygen Demand, Suspended Solids, Volatile Suspended Solids, Total Dissolved Solids, Total Phosphorous, Total Nitrogen and Lead). In addition a limited number of samples were analyzed for Total Coliforms, fecal Coliforms, Cadmium, Chromiun, Mercury, Zinc and Copper. A full description of the monitoring program, as originally proposed, and presentation of results is contained in Appendix B.

MONITORING STATIONS and MAC WATERSHEDS

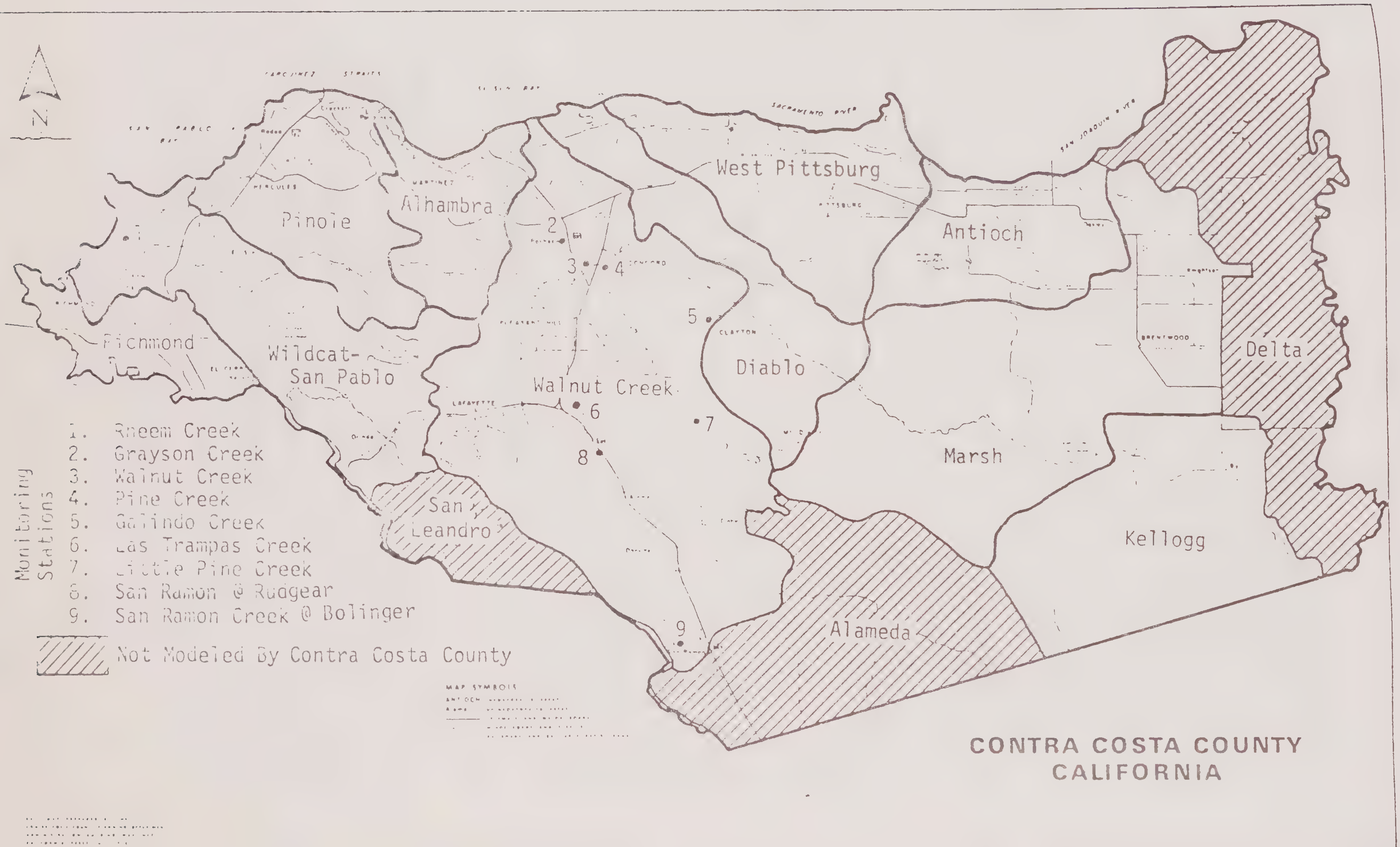


TABLE A-6

SUMMARY OF MONITORING RESULTS

STATION	FLOW (cfs)	BOD (mg/1)	SS (mg/1)	YSS (mg/1)	TDS (mg/1)	TOTAL P (mg/1)	TOTAL N (mg/1)	LEAD (mg/1)
1. San Ramon @ SR	1.2	6	120	24	580	.64	2.66	.07
	3.5	8	300	50	440	.69	3.11	.03
	1.4	4	110	22	430	.38	2.13	.02
2. San Ramon W.C.	76	10	170	25	550	.57	2.7	.08
	79	7	76	12	570	.26	2.05	.07
	48	7	150	22	570	.46	2.22	.05
3. Walnut Creek @ Diamond	34	6	76	33	520	.31	4.57	.05
	145	11	190	26	2,500	.56	3.0	.18
	160	11	140	24	310	.56	2.7	.15
	139	7	120	19	320	1.5	2.28	.08
	170	10	140	26	350	.49	2.73	-
	187	4	250	21	240	.42	2.82	-
	39	13	6	3	600	.22	0.96	-
4. Pine Creek @ Market		18	150	27	400	.40	7.32	.31
		14	220	39	260	.56	4.4	.26
		10	300	37	220	.54	3.6	.01
		10	310	38	200	.48	3.1	.11
		15	450	67	190	.63	3.72	.52
		13	710	88	250	1.9	4.84	.33
		11	500	59	2,300	.48	4.76	.25
		14	100	20	620	.18	2.45	
		12	230	36	230	.42	1.62	
		14	140	5	250	.44	1.68	
		19	10	2	800	.02	3.01	
5. Little Pine		10	5,200	550	380	2.4	16.2	
6. Galindo		16	32	2	910	.08	6.50	
7. Las Trampas @ Main		6	230	36	180	.50	1.75	.17
8. Grayson @ Center		11	83	18	680	.27	2.07	
9. Rheem @ Gage		13	73	16	2,000	1.2	5.38	.35
	01	40	130	32	3,400	3.9	4.78	.45
	35	23	280	32	3,300	.68	5.20	.45
	29	18	130	22	190	.46	3.65	.24

Of major concern was the possible effect of minimal runoff occurrences upon the validity of interpretation of results of the monitoring program. Examination of results from prior monitoring programs (primarily within Alameda County) and comparison to this years program results seems to indicate that even with the minimal runoff experienced the results observed for BOD, Total nitrogen and Total Phosphorous are reasonably representative of conditions which might be experienced under more normal runoff conditions.

No interpretation of the results for Total Dissolved Solids (TDS) is possible, however some of the high values (above 1000 mg/l) suggests that a more complete chemical analysis would be warranted to ascertain if any particular constituent is predominant and the potential impact of that finding.

A review of past studies as well as results from other monitoring programs indicates that the results obtained from this monitoring program for Suspended Solids (and probably volatile Suspended Solids) may not be representative of more normal runoff conditions. In a study conducted by the U.S. Geological Service on sediment transport and deposition in Walnut and Pacheo Creeks it was found that the long term (1906 to 1962) average suspended sediment discharge of Walnut Creek at Walnut Creek was 87,300 tons per year. This would mean that the average concentration of suspended sediments was approximately 2700 mg/l. It was also found that in excess of 90 percent of the suspended sediment load in Walnut Creek was transported by less than 50 percent of the streamflow and that this streamflow occurred in only one percent of the time. In other words most of the sediment was transported during infrequent periods of higher streamflow. Also if the primary consideration of suspended solids is the determination of the quantity of suspended solids reaching the Bay-Delta Estuarine System then the amount

of sediments which settle out in the lower slow moving reaches of the creeks and streams must be taken into account. It was estimated in this same study that 65 percent of the sediment load settled out in the lower reaches of Walnut Creek.

The ramifications of suspended solids concentrations are discussed later in this report however the entire subject of sediment transport, sorption of heavy metals and potential effects upon receiving waters warrants further study.

THE MATHEMATICAL MODELING PROGRAM

As a means of insuring a uniform approach in the counties determination of pollutant loadings and the evaluation of control measures ABAG furnished two mathematical models to each of the counties:

The Macroscopic Planning Model (MAC) and

The Storm Water Management Model (SWMM).

The use of these models was considered by ABAG staff as necessary to ensure that data from all counties would be based upon identical considerations and would be reported in a uniform format to facilitate the subsequent preparation of the Regional Surface Runoff Management Plan.

These mathematical models are tools to facilitate and expedite the compilation of a large number of mathematical computations. The applicability of results obtained from these models is directly related to the accuracy of the mathematical relationships utilized in the model and to the reliability of the basic input data provided.

The Macroscopic Planning Model (MAC)

The MAC model is used to determine total pollutant loadings from large areas over an extended time period. The overall concept is that the pollutant

loading from an area equals the product of the surface runoff from that area times the concentration of that pollutant contained in the runoff. This is represented by the formula:

$$M = K \times P \times A \times C \times 0.227$$

Where:

M = pollutant load in pounds

K = runoff coefficient one for each land use (equivalent to percent of rainfall which runs off a land surface)

P = precipitation in inches

A = area in acres (for each land use in a watershed subunit)

C = average pollutant concentration in runoff from each land use (in milligrams per liter)

0.227 = unit conversion factor

The two most variable (and most difficult to ascertain) factors in the above equation are the runoff coefficient (K) and the pollutant concentration (C). Appendix C contains the data utilized in the determination of the "K" factors and discusses the reliability of those factors. The conclusions reached in attempting to calibrate the MAC model for runoff are:

1. On an annual basis the utilization of a constant "K" factor will result in a predicted runoff of plus or minus 50 percent of actual.

2. The critical and most variable "K" factor is that for open space.

3. The utilization of the MAC model for examination of predicted runoffs for a specific storm or for a maximum month condition is inadvisable.

4. The utilization of the MAC model should be limited to examination of long term average conditions.

The selection of "C" values (average pollutant concentration) is the second major variant affecting the credibility of numerical pollutant loadings derived utilizing the MAC model.

The average pollutant concentration (C) is a measurement of the quantity of a specified pollutant from a designated land use contained in a unit volume of surface runoff. Generally this is expressed in milligrams per liter. Two sources of data were utilized to select C values for each pollutant for each type of land use. One source was the so-called national averages derived from examination of a number of surface runoff studies throughout the world. The second source was the results of the monitoring programs conducted within each of the Bay Area counties. Table A-7 gives the national average C values for the major land use categories and the "calibrated" values used for the final MAC runs.

TABLE A-7

POLLUTANT CONCENTRATION COEFFICIENTS

LAND USE	Pollutant Concentration (mg/1)				
	BOD	SS	VSS	TOTP	TOTN
Residential*					
National	10.4	211.5	123	0.44	7.01
Local	15	250	62	0.4	3.5
Commercial					
National	41.5	288.1	181.7	0.98	3.84
Local	20	150	70	0.7	5
Industrial					
National	15.8	377.6	186.8	0.91	3.58
Local	13	120	50	0.5	3
Open Space					
National	0.21	4.97	4.79	0.02	0.11
Local	4	800 **	30	0.3	2

*Values to be modified according to population density

**Value modified according to local conditions

As can be seen from Table A-7 the changes in C values from the National Averages were, in the main, very substantial. This is particularly true for the Open Space category of land use. As noted earlier the concentration of suspended solids found in this county's monitoring program for Open Space is not considered to be representative of "average" conditions. Consequently the pollutant concentration coefficient for Open Space was adjusted to 800 mg/1 which appears to be more representative of "average year" conditions.

It is also noted that none of the other coefficients for Open Space were likewise arbitrarily adjusted. Should further monitoring of runoff from Open Space be performed it is very probable that substantial modifications of these coefficients for Open Space will be justified.

The remaining variables of precipitation and land use are reasonably well established. Sufficient precipitation records and analysis is available so that the reliability of that variable is considered quite good. The areas of land use were developed by ABAG for 1975, 1985 and year 2000 levels of development, based upon the Provisional Series 3 Projections, Base Case 1 for 1985 and an alternative for the year 2000. The land use figures prepared by ABAG are not in agreement with County projections for land consumption for residential use for the years 1985 and 2000. However, for purposes of modeling differences of up to 25 percent would have a negligable effect upon projected pollutant loadings from any specific watershed.

Taking all of the above factors into consideration two conclusions may be drawn:

1. The utilization of pollutant loadings developed from MAC must be used with great care and the knowledge that any specific figure could vary by as much as 50 to 100 percent.
2. The major value of the MAC model lies in its potential usage for comparison of changes in pollutant loadings brought about by development or the application of a specific control measure.

Use of MAC

The initial step in the use of MAC was the division of the County into major watersheds (MAC watersheds). For the purpose of this study thirteen

MAC watersheds were delineated. These MAC watersheds are illustrated on Figure A-1.

As stated earlier, some rather significant areas were deleted from detailed examination since they are either included in the Alameda County study or surface runoff from those areas does not directly reach the Bay-Delta Estuarine System. In all ten MAC watersheds or some 342,000 acres of land were modeled on MAC.

The MAC watersheds were further subdivided into sub-areas somewhat along census tract boundaries, representing developed areas, developing and developable areas, and permanent (to the year 2000) open space. This latter breakdown proved to be somewhat misleading due to errors accumulated by attempting to delineate land uses by census tracts.

For each MAC watershed and sub-area the appropriate runoff coefficient for each land use was established, the representative precipitation factor determined and the areas of each land use type for the years 1975, 1985 and 2000 were tabulated.

Initially three MAC runs were made, one for each level of development, 1975, 1985 and year 2000. Additional runs were then made for the purpose of identifying the pollutant loading from each type of land use - open space, residential, commercial and industrial. This latter type of breakdown is extremely useful in identifying significant sources of pollutant loadings and in the evaluation of the effectiveness of various control measures or combinations of control measures in the reduction of pollutant loadings to the Bay-Delta Estuarine System.

MAC Results

It is emphasized that the numerical values reported herein are to be considered as rough approximations.

Table A-8 is a tabulation by MAC watershed and sub-area of the average annual pollutant loadings at the 1975, 1985 and year 2000 levels of development.

Figures A-5 through A-18 depict the land use characteristics and pollutant loadings from each land use category for each of the MAC watersheds, for consolidated areas representing the western, central and eastern areas of Contra Costa County, and for a composite of the entire modeled area of the county.

Table A-9 is a tabular summary of total annual surface runoff pollutant loadings compared to total annual point discharge loadings for the western, central and eastern areas of the county and for the entire county for the three levels of development (point discharge loadings are those resulting from municipal wastewater treatment plants and from direct industrial discharges). The point discharge loadings were developed by ABAG staff based upon available records and projections contained in the project reports for municipal wastewater treatment facilities. Projections of industrial loadings are based upon industries meeting the "best available treatment" requirements as established by Federal law and regulations.

Figure A-16 is a graphical representation of Table A-9.

A further comparison of surface runoff pollutant loadings can be made to the loadings resulting from Delta outflow. The following preliminary comparison of 1975 level loadings is offered:

<u>BOD</u>	
Surface Runoff	2,250,000 pounds
Delta Outflow	52,000,000 pounds
<u>Suspended Solids</u>	
Surface Runoff	160,650,000 pounds
Delta Outflow	4,200,000,000 pounds

Total Nitrogen

Surface Runoff	700,000 pounds
Delta Outflow	27,000,000 pounds

Total Phosphorous

Surface Runoff	100,000 pounds
Delta Outflow	5,000,000 pounds

An indication of the effects of development can have upon surface runoff pollutant loadings can be gained by examination of Table A-10 which lists the annual pollutant loadings estimated for each MAC watershed in pounds per acre.

TABLE A-8

SUMMARY OF MAC MODELING RESULTS

MAJOR WATERSHED NAME	SUB-AREA	AREA IN ACRES	CITIES AND COMMUNITIES	ANNUAL POLLUTANT LOADS (1000's of pounds) 1975 DEVELOPMENT					ANNUAL POLLUTANT LOADS (1000's of pounds) 1985 DEVELOPMENT					ANNUAL POLLUTANT LOADS (1000's of pounds) 2000 DEVELOPMENT				
				BOD	SS	VSS	Tot P	Tot N	BOD	SS	VSS	Tot P	Tot N	BOD	SS	VSS	Tot P	Tot N
1. Marsh Cr.	A	44866	Brentwood, Knightsen	85	16788	633	6	42	84	16783	631	6	42	85	16781	633	6	42
	B	25981		41	6178	268	3	18	41	6135	270	3	18	62	5756	342	3	21
Subtotal		70847		126	22966	901	9	60	125	22918	901	9	60	147	22537	975	9	63
2. Kellogg		41059	Byron	77	15350	578	6	39	78	15347	578	6	39	79	15314	582	6	39
3. Walnut Cr.	B	57163	Walnut Creek, Concord	299	33166	1738	16	112	365	29380	1918	16	120	390	27248	1978	17	123
	C	33954	Lafayette, Pleasant Hill,	578	17224	2466	20	151	636	16083	2664	21	162	689	15095	2841	22	172
Subtotal		91117	Moraga, Alamo, Danville, Pacheco	877	50390	4204	36	263	1001	45463	4582	37	282	1079	42343	4019	39	295
4. Diablo	B	20131	Clayton, Clyde	78	11027	500	5	33	81	10631	505	5	33	102	9880	570	5	36
	C	6858		25	3794	162	2	11	25	3784	164	2	11	26	3757	169	2	11
Subtotal		26989		103	14821	662	7	44	106	14415	669	7	44	128	13637	739	7	47
5. Alhambra	A	7129	Martinez, Mt. View	22	4009	158	2	10	28	3584	172	2	11	29	3492	173	2	11
	B	1628		15	708	67	1	4	25	528	103	1	6	29	414	114	1	7
	C	6804		75	2337	327	3	20	73	2762	322	3	20	86	2718	369	3	22
Subtotal		15661		112	7554	552	6	34	126	6874	597	6	37	144	6624	656	6	40
6. San Pablo	A	22244	San Pablo, North Richmond,	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
	B	8226	Orinda, El Sobrante, Pinole	84	5893	423	4	27	109	4693	497	4	30	117	4236	520	4	31
	C	8468		135	4447	585	5	36	148	4223	629	5	33	153	4157	645	5	39
Subtotal		38938		219	10340	1008	9	63	257	8916	1126	9	63	270	8393	1165	9	70
9. Pinole	A	13986	Pinole, Hercules, Rodeo,	57	10699	413	4	27	72	9384	446	4	29	73	9175	449	4	29
	B	10371	Crockett, Port Costa	87	5480	424	4	27	122	4392	537	4	33	133	3985	574	4	34
Subtotal		24357		144	16179	837	8	54	194	13776	983	8	62	206	13160	1023	8	63
12. Antioch	A	6291	Antioch, Oakley	13	2507	95	1	6	16	2316	105	1	7	20	2113	114	1	7
	B	4947		9	1502	61	1	4	10	1459	66	1	4	16	1251	84	1	5
	C	7959		79	2752	344	3	21	83	2612	355	3	22	117	2202	473	4	29
Subtotal		19197		101	6761	500	5	31	109	6387	526	5	33	153	5566	671	6	41
13. W.Pittsburg	A	7721	Pittsburg, West Pittsburg,	20	3001	129	1	9	18	2993	125	1	8	20	2964	130	1	8
	C	16206	Shore Acres	123	6240	564	5	36	133	5987	596	5	38	159	5506	683	6	43
Subtotal		23927		143	9241	693	6	45	151	8980	721	6	46	179	8470	813	7	51
16. Richmond	C	12339	Richmond, El Cerrito	350	7048	1418	12	87	358	6798	1442	12	88	369	6690	1482	12	91
TOTAL		364331		2252	160650	11353	104	720	2505	149874	2125	105	753	2754	142736	12925	109	800

MAC WATERSHED CHARACTERISTICS - MARSH CREEK

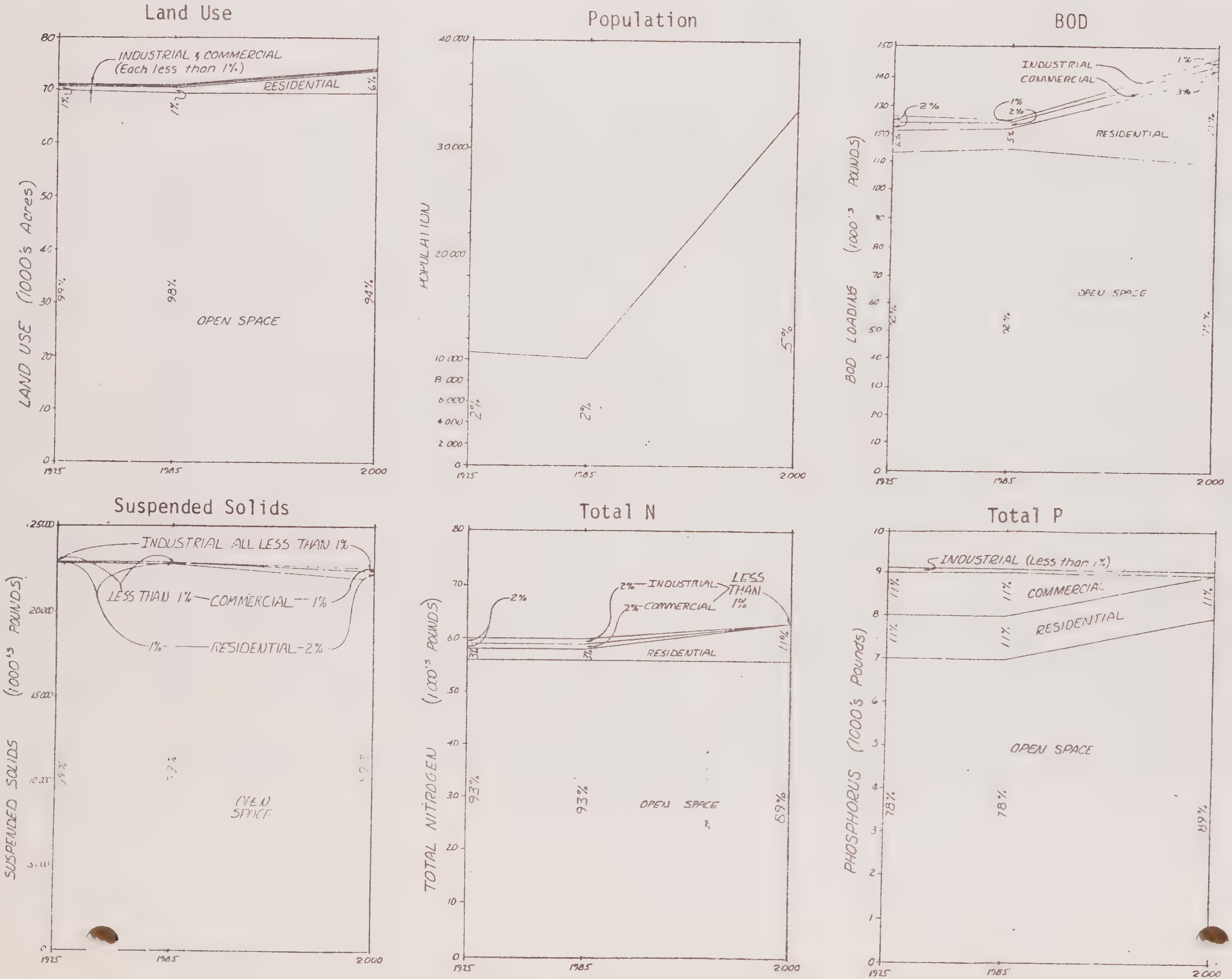


FIGURE A-2

MAC[illegible]TERSHED CHARACTERISTICS - KELLOGG

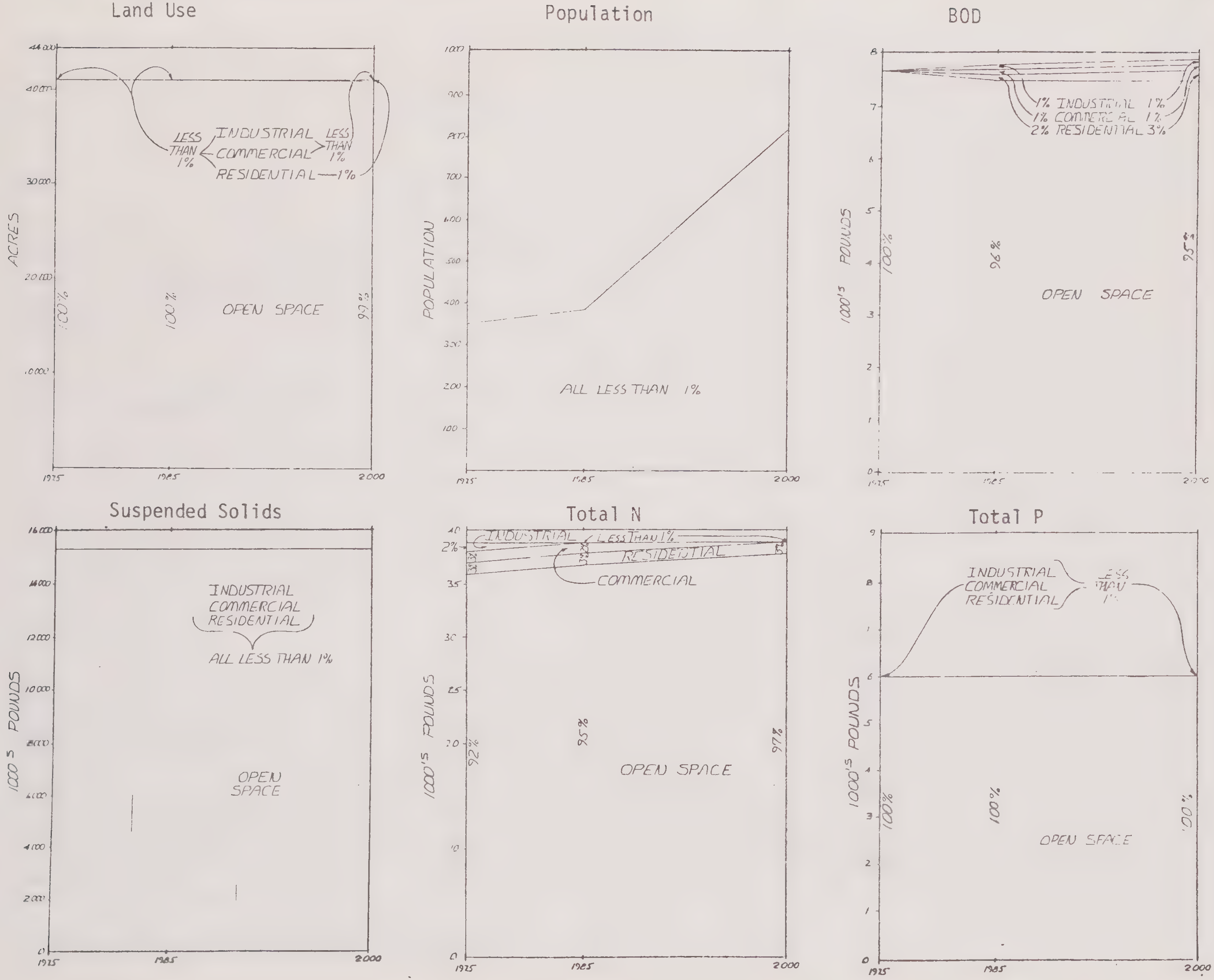


FIGURE A-3

MAC WATERSHED CHARACTERISTICS - WALNUT CREEK

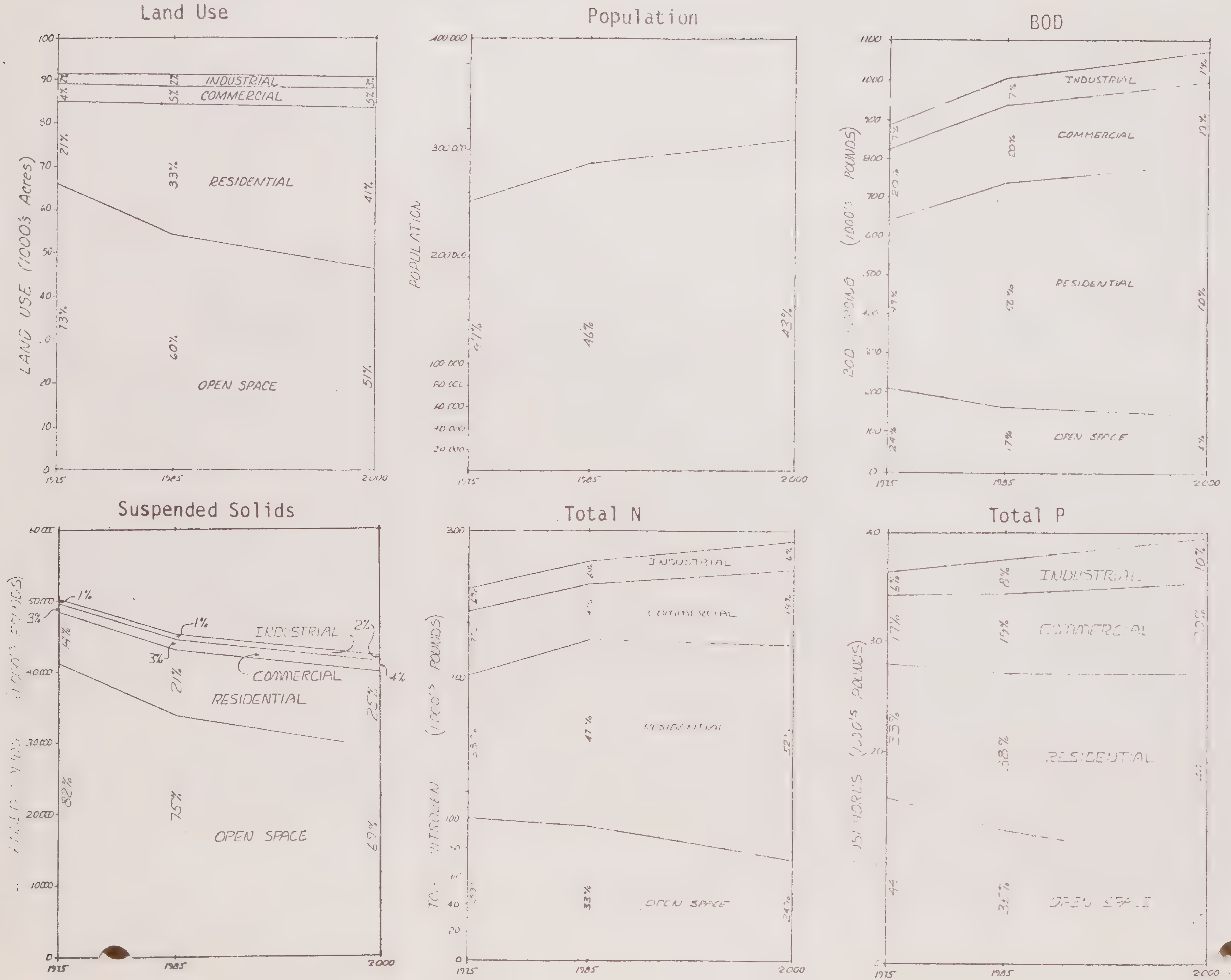


FIGURE A-4

MAC[illegible]ATERSHED CHARACTERISTICS - DIABLO

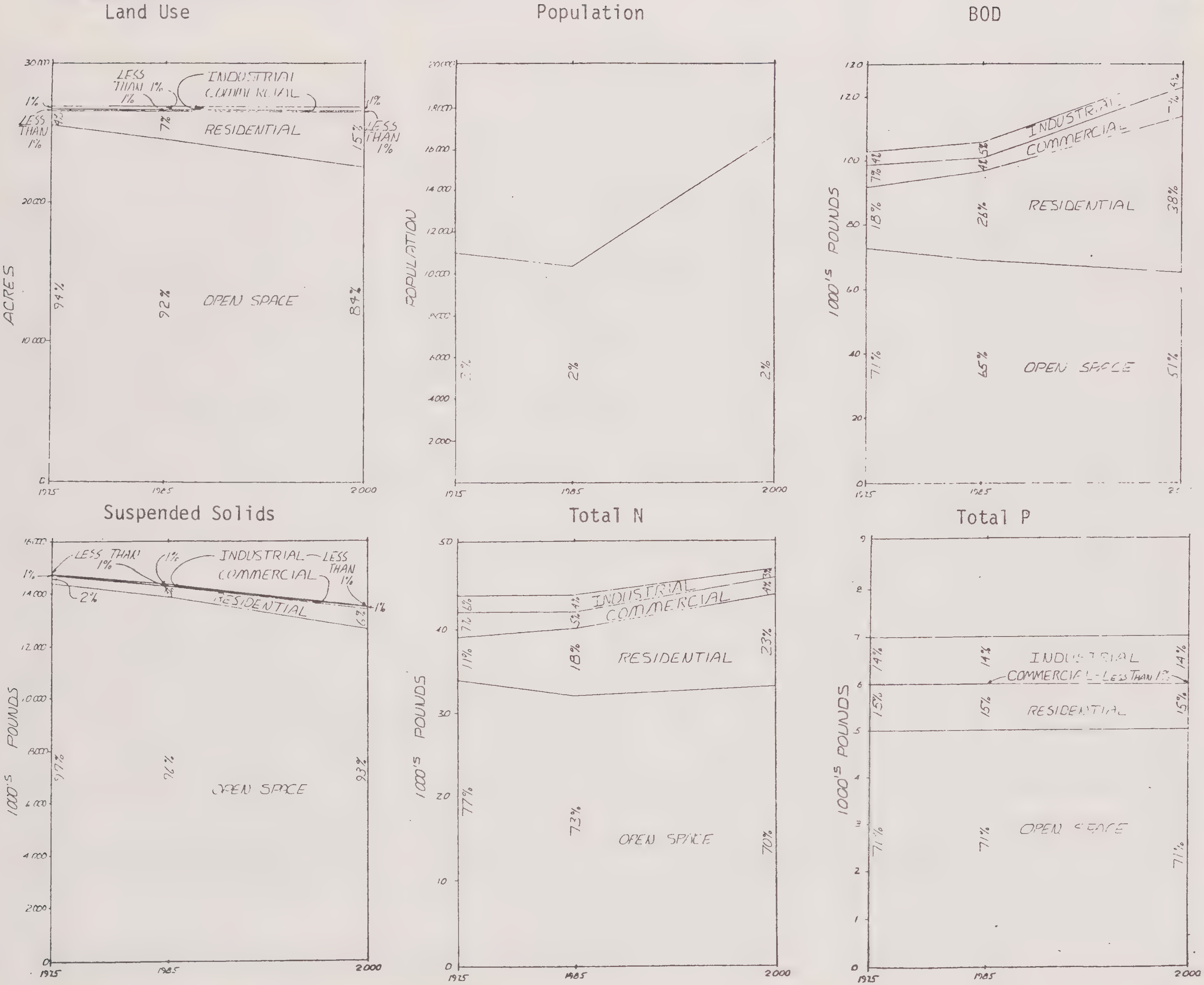


FIGURE A-5

MAC WATERSHED CHARACTERISTICS - ALHAMBRA

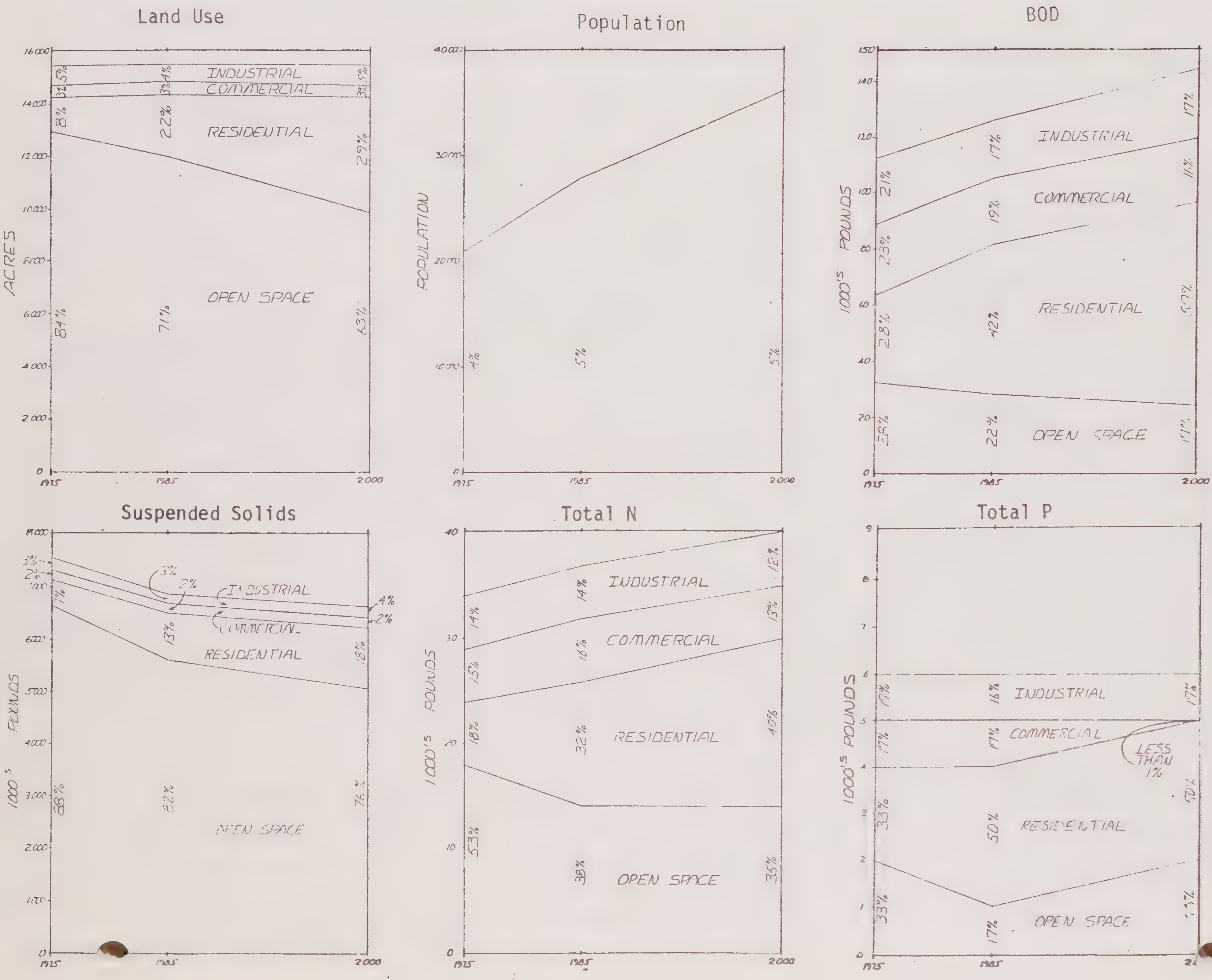


FIGURE A-6

MAC TERSHED CHARACTERISTICS - SAN PABLO

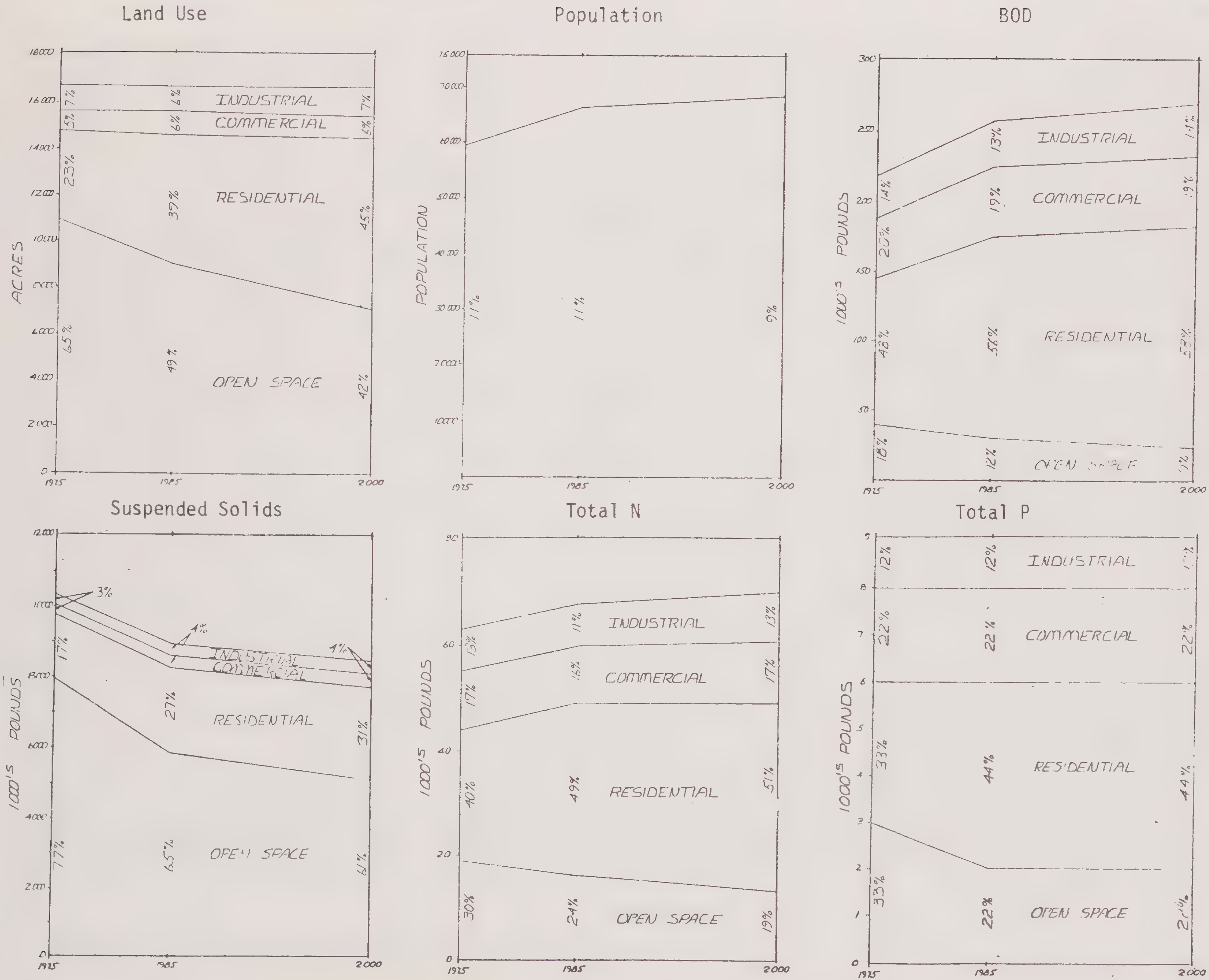
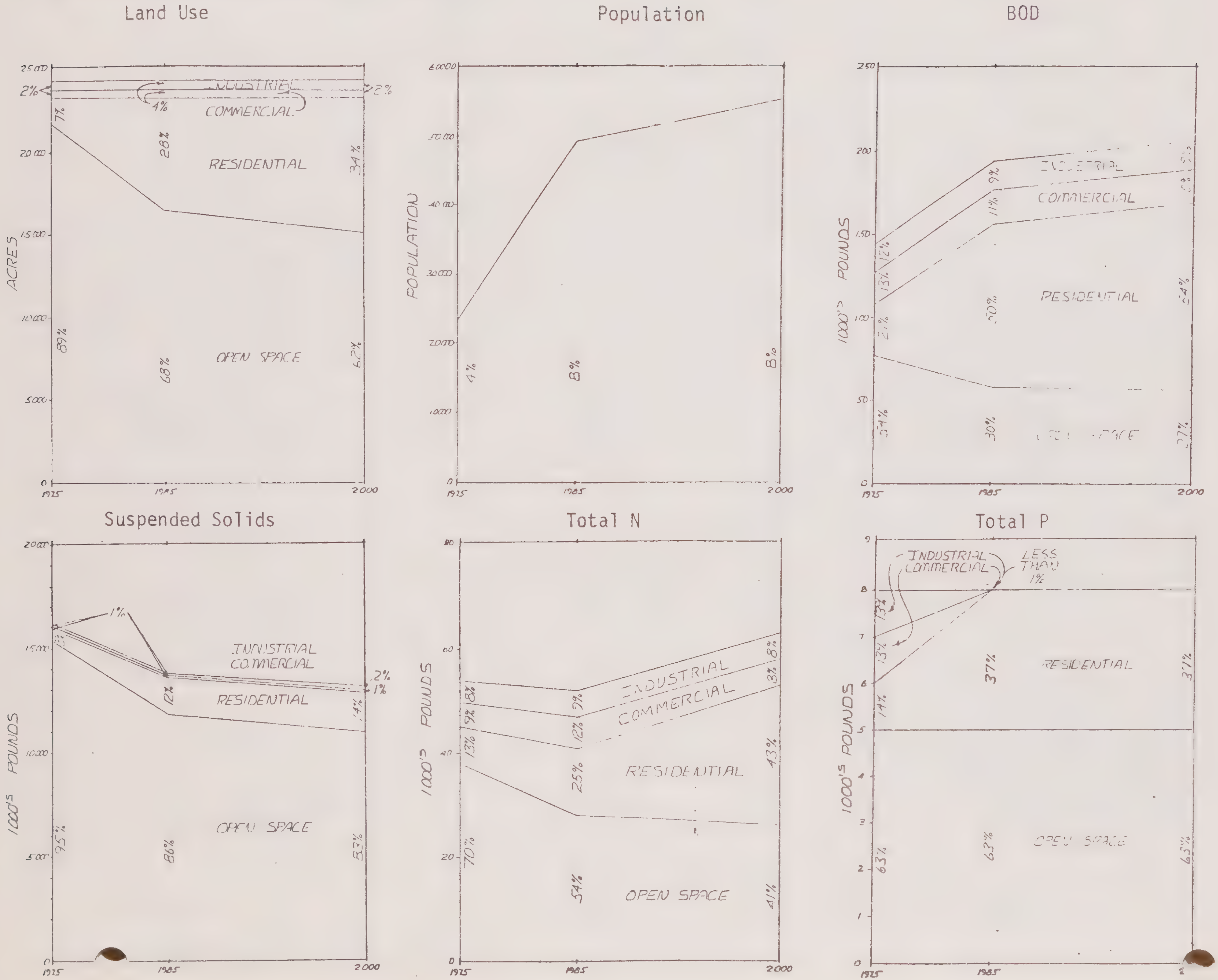


FIGURE A-7

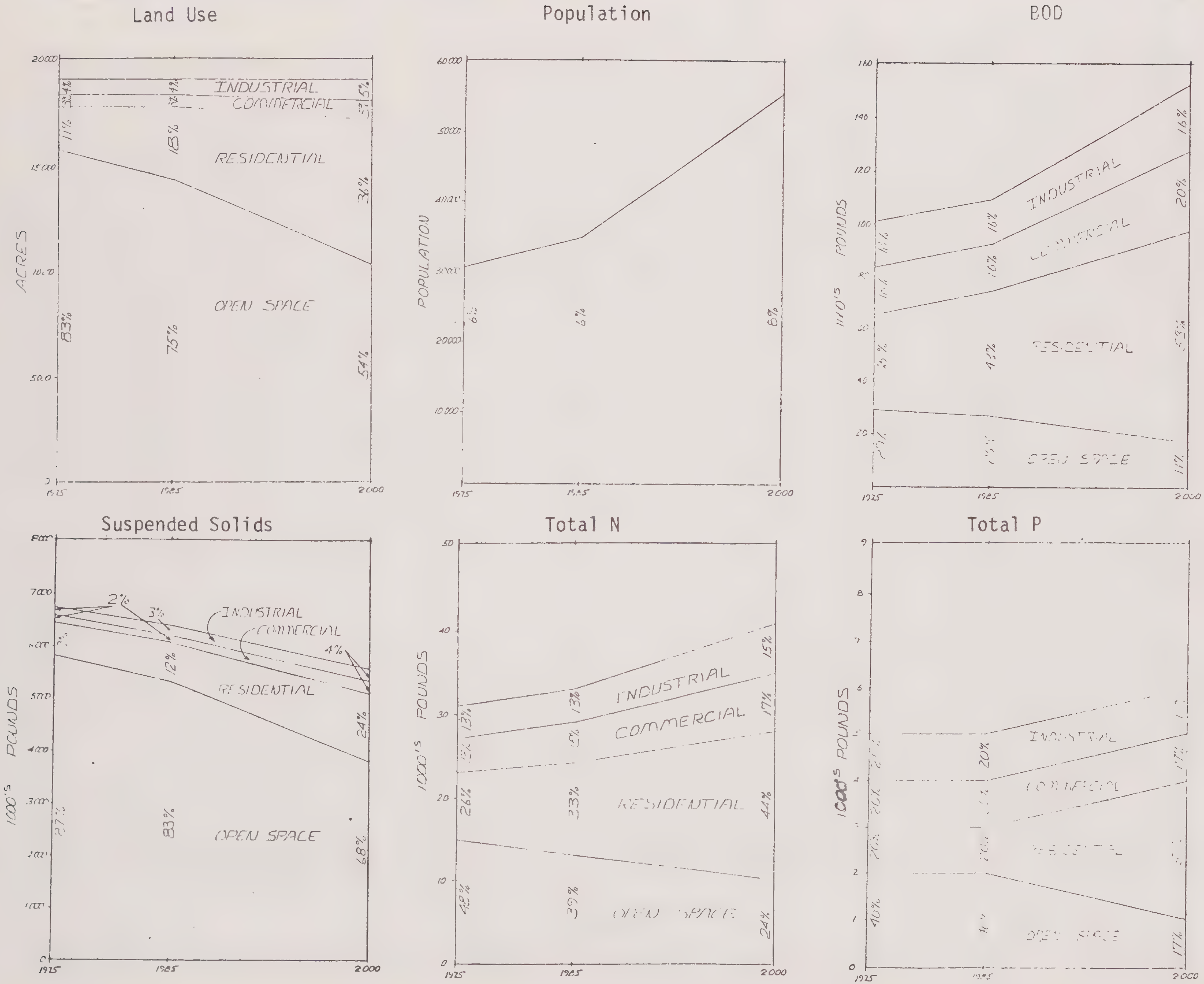
MAC WATERSHED CHARACTERISTICS - PINOLE



A-60

FIGURE A-8

MAC[illegible]ATERSHED CHARACTERISTICS - ANTIOCH



A-61

FIGURE A-9

MAC WATERSHED CHARACTERISTICS - WEST PITTSBURG

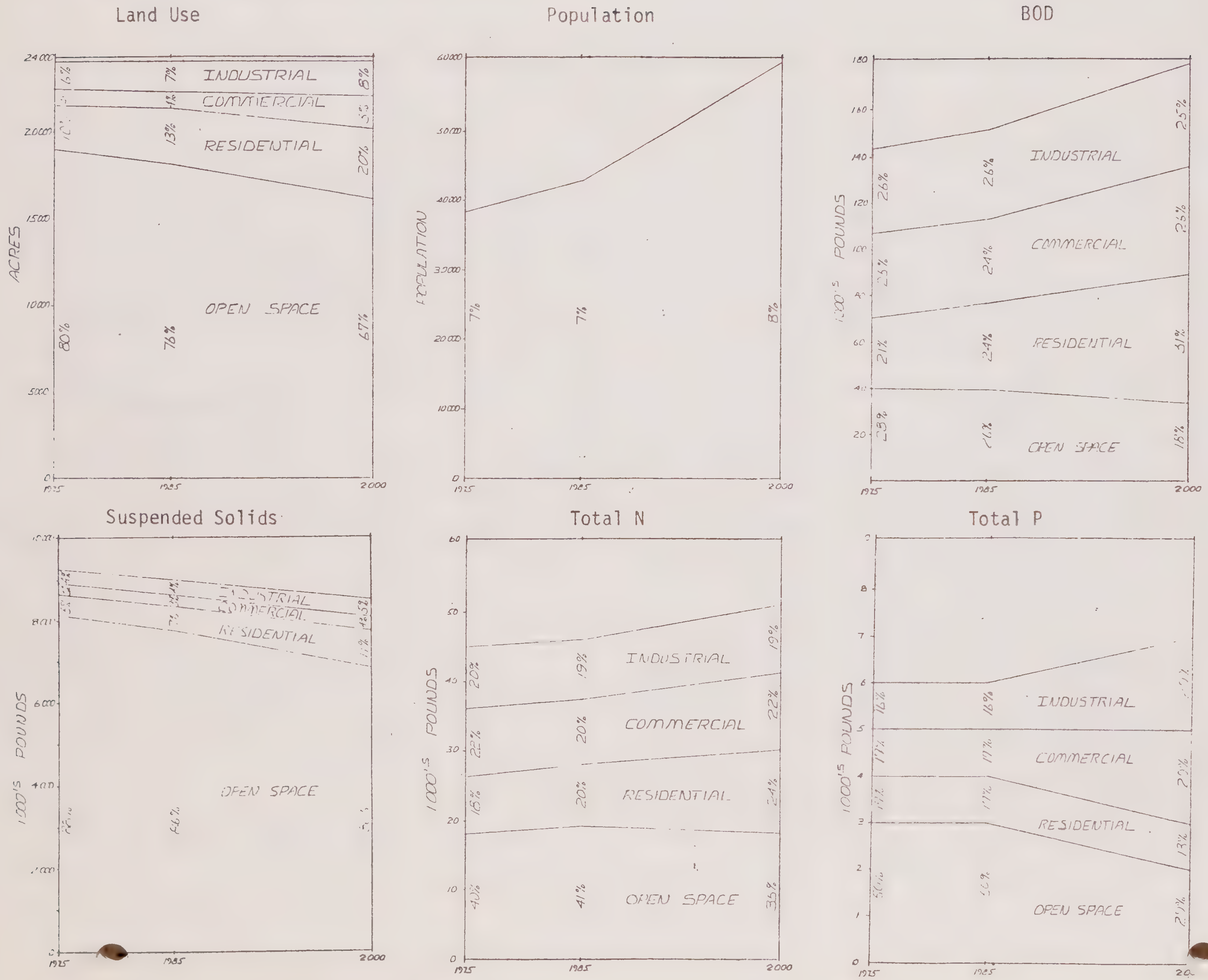


FIGURE A-10

MA ATERSHED CHARACTERISTICS - RICHMOND

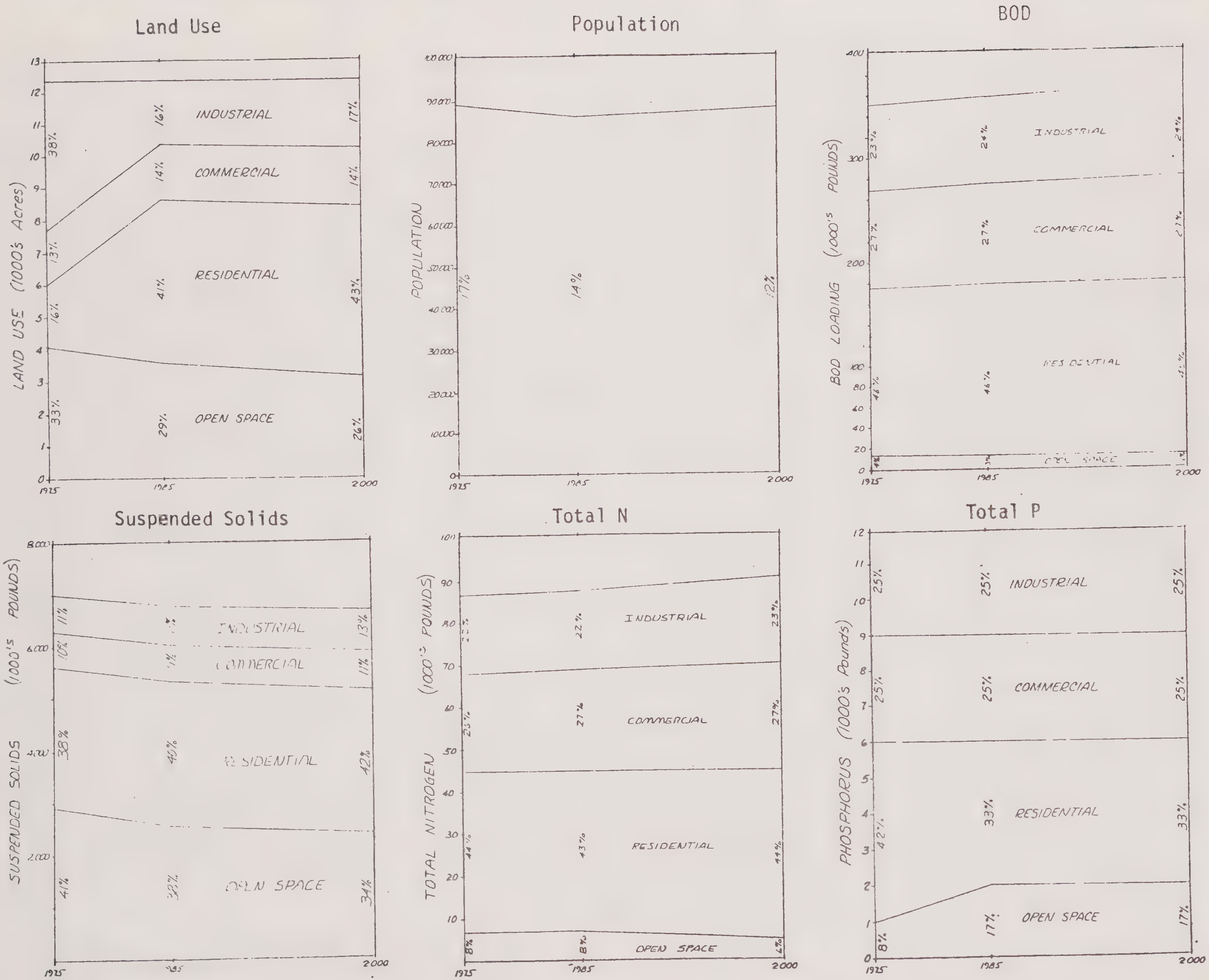


FIGURE A-11

MAC WATERSHED CHARACTERISTICS - WESTERN COUNTY

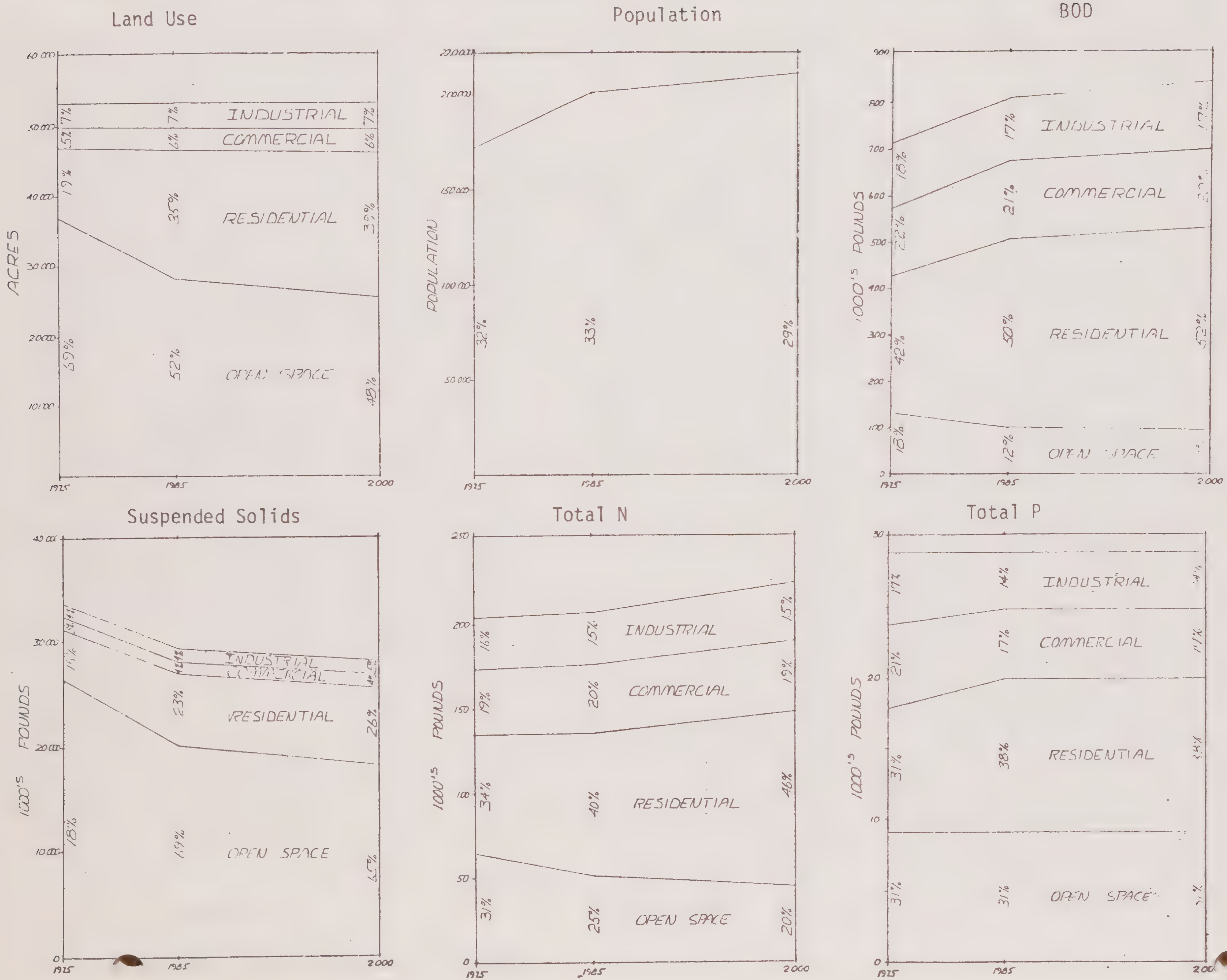


FIGURE A-12

MAC TERSHED CHARACTERISTICS - CENTRAL COUNTY

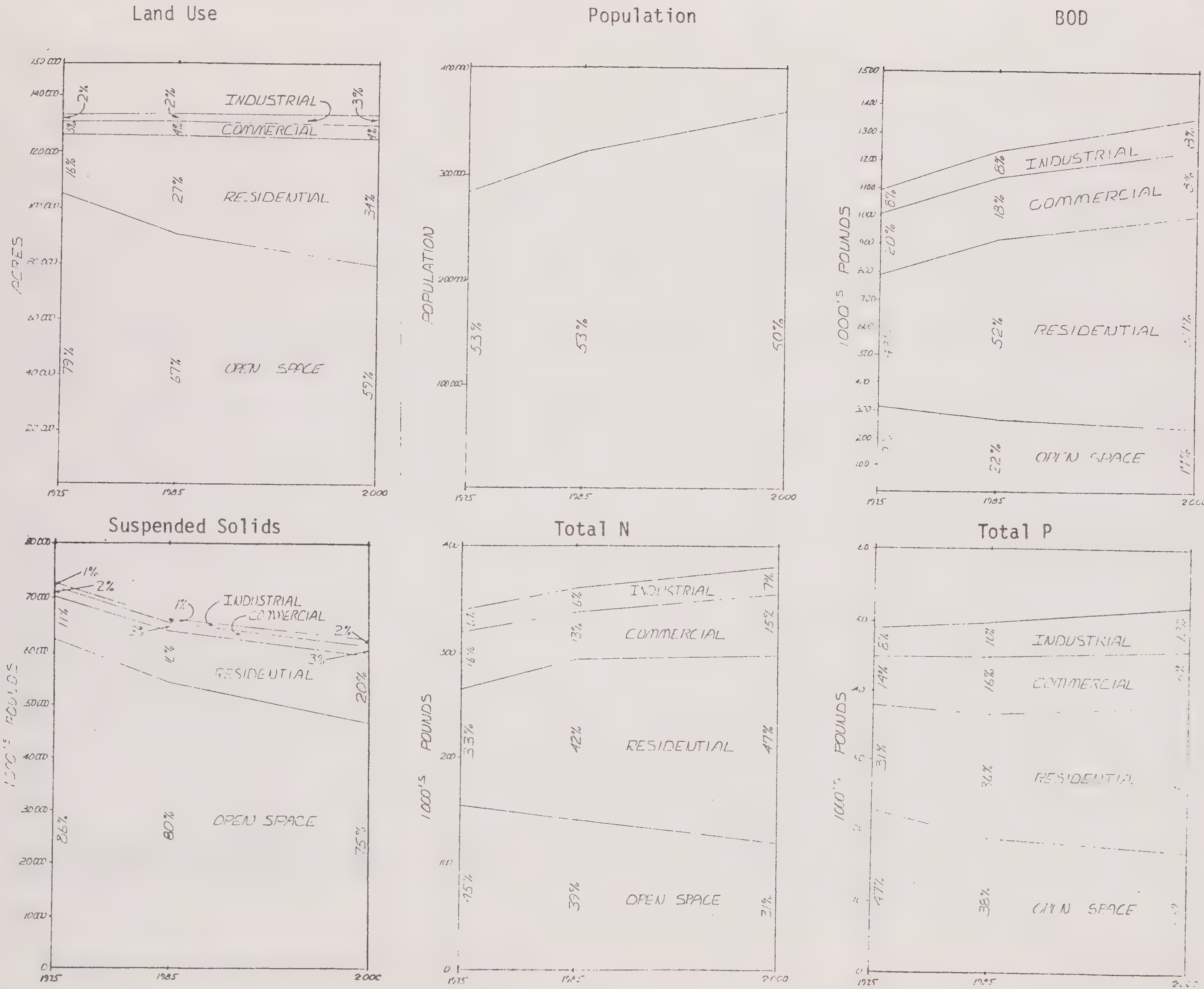


FIGURE A-13

MAC WATERSHED CHARACTERISTICS - EASTERN COUNTY

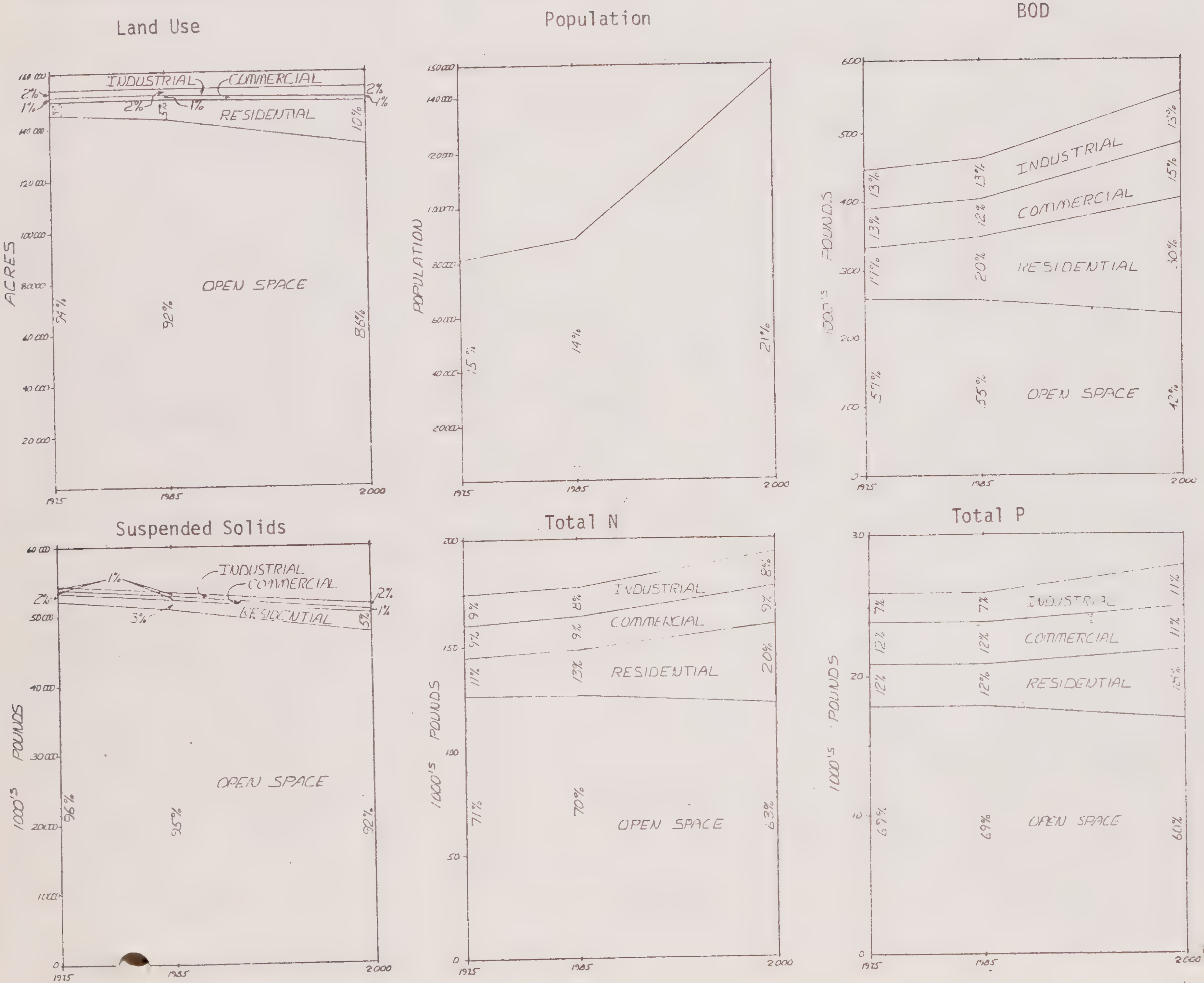
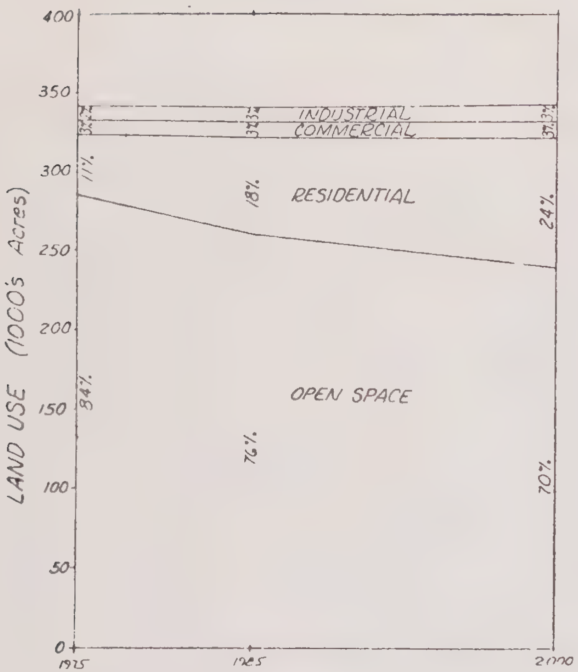


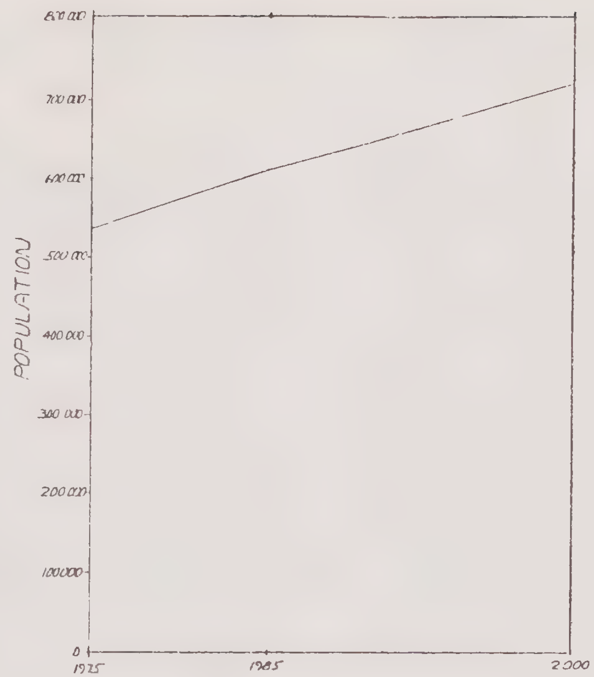
FIGURE A-14

MAC[illegible]TERSHED CHARACTERISTICS - COUNTY

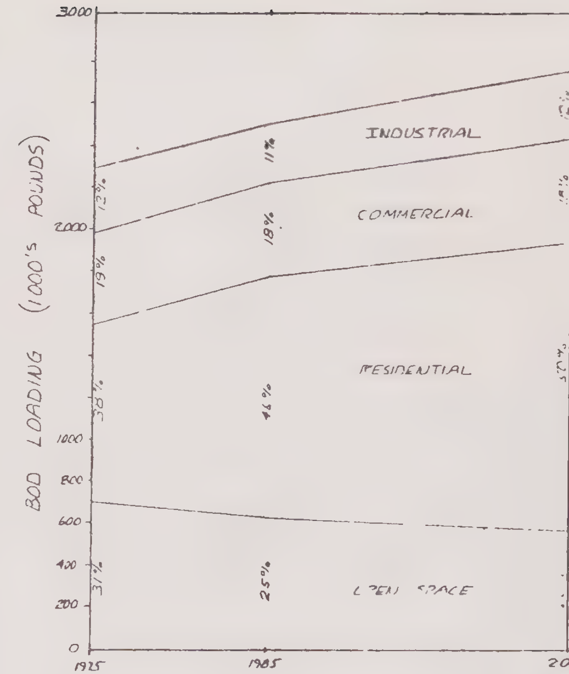
Land Use



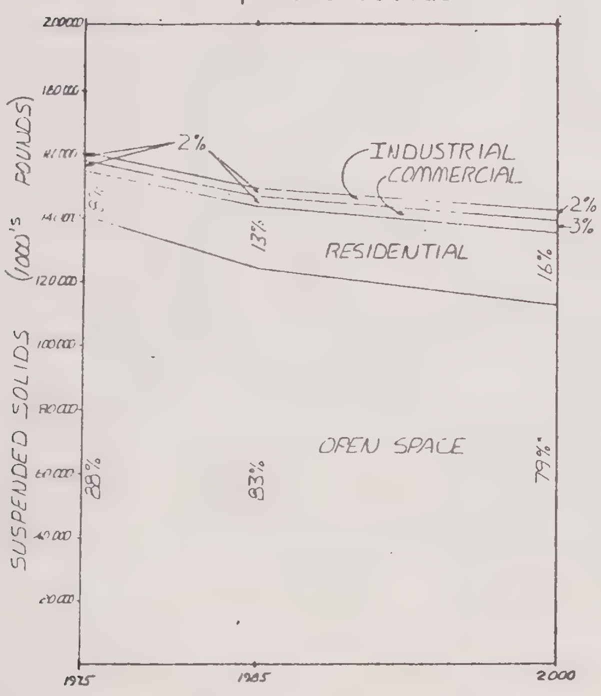
Population



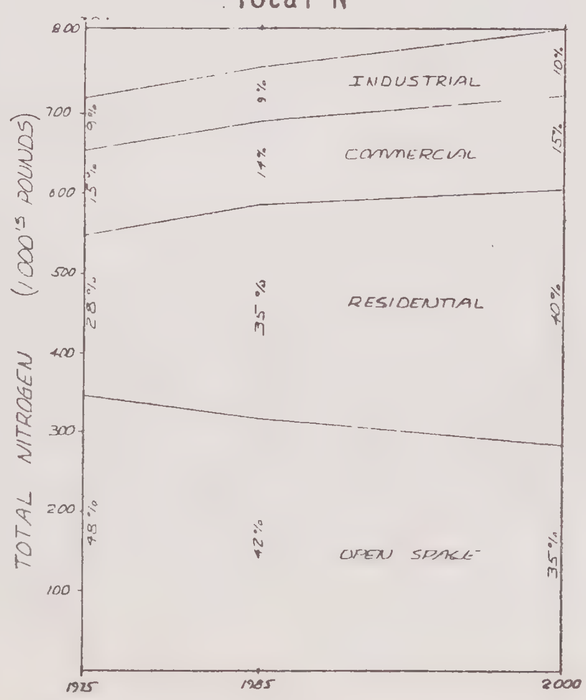
BOD



Suspended Solids



Total N



Total P

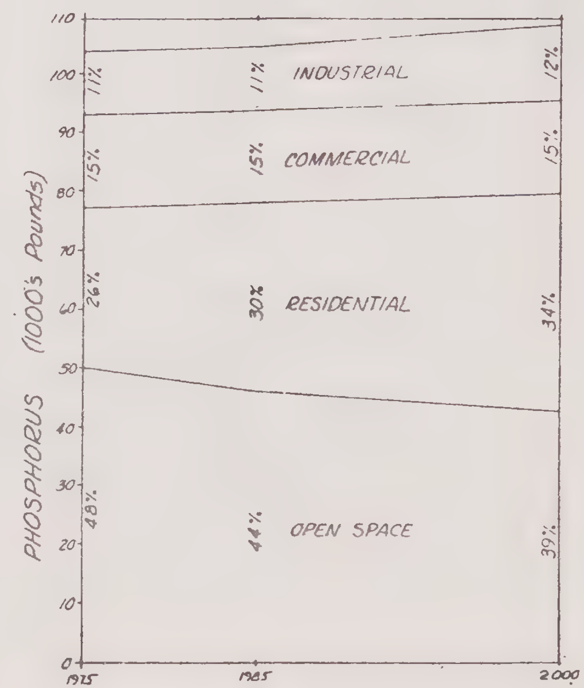


TABLE A-9

SUMMARY OF POINT AND SURFACE
RUNOFF LOADINGS TO BAY-DELTA

(In Thousands of Pounds)

1975	BOD	(%)	SS	(%)	TN	(%)	TP	(%)
WEST								
Municipal	589	(1)	869	(0)	1026	(16)	1839	(45)
Industrial	10751	(19)	5462	(3)	849	(13)	7	(0)
Point	11340	(20)	6331	(3)	1875	(29)	1846	(45)
Surface	713	(1)	33567	(18)	204	(3)	29	(1)
Total	12053	(21)	39898	(21)	2079	(32)	1875	(46)
CENTRAL								
Municipal	9761	(17)	6947	(4)	2941	(44)	1960	(48)
Industrial	308	(1)	710	(0)	303	(5)	-0-	(0)
Point	10069	(18)	7657	(4)	3244	(49)	1960	(48)
Surface	1092	(2)	72765	(40)	341	(5)	49	(1)
Total	11161	(20)	80422	(44)	3585	(54)	2009	(49)
EAST								
Municipal	1898	(3)	1091	(1)	507	(8)	109	(3)
Industrial	31941	(56)	7081	(4)	237	(3)	51	(1)
Point	33839	(59)	8172	(5)	744	(11)	160	(4)
Surface	447	(1)	54318	(31)	175	(3)	26	(1)
Total	34286	(60)	62490	(35)	919	(14)	186	(5)
Total Point	55248	(96)	22160	(12)	5863	(89)	3966	(97)
Total Surface	2252	(4)	160650	(88)	720	(11)	104	(3)
TOTAL	57500	(100)	182810	(100)	6583	(100)	4070	(100)

TABLE A - 9 (continued)

SUMMARY OF POINT AND SURFACE RUNOFF LOADINGS TO BAY-DELTA

(In Thousands of Pounds)

1985	BOD	(%)	SS	(%)	TN	(%)	TP	(%)
WEST								
Municipal	1744	(21)	1744	(1)	1474	(42)	1126	(42)
Industrial	847	(11)	810	(1)	334	(10)	3	(0)
Point	2591	(32)	2554	(2)	1808	(52)	1129	(42)
Surface	809	(10)	29490	(19)	218	(6)	29	(1)
Total	3400	(42)	32044	(21)	2026	(58)	1158	(43)
CENTRAL								
Municipal	237	(3)	118	(0)	237	(7)	1184	(44)
Industrial	234	(3)	274	(0)	195	(5)	0	(0)
Point	471	(6)	392	(0)	432	(12)	1184	(44)
Surface	1233	(15)	66752	(43)	363	(11)	50	(2)
Total	1704	(21)	67144	(43)	795	(23)	1234	(46)
EAST								
Municipal	638	(8)	638	(0)	425	(12)	212	(7)
Industrial	1887	(23)	2993	(2)	68	(2)	68	(3)
Point	2525	(31)	3631	(2)	493	(14)	280	(10)
Surface	463	(6)	53632	(34)	178	(5)	26	(1)
Total	2988	(37)	57263	(36)	671	(19)	306	(11)
Total Point	5587	(69)	6577	(4)	2733	(78)	2522	(96)
Total Surface	2505	(31)	149874	(96)	759	(22)	105	(4)
TOTAL	8092	(100)	156451	(100)	3492	(100)	2626	(100)

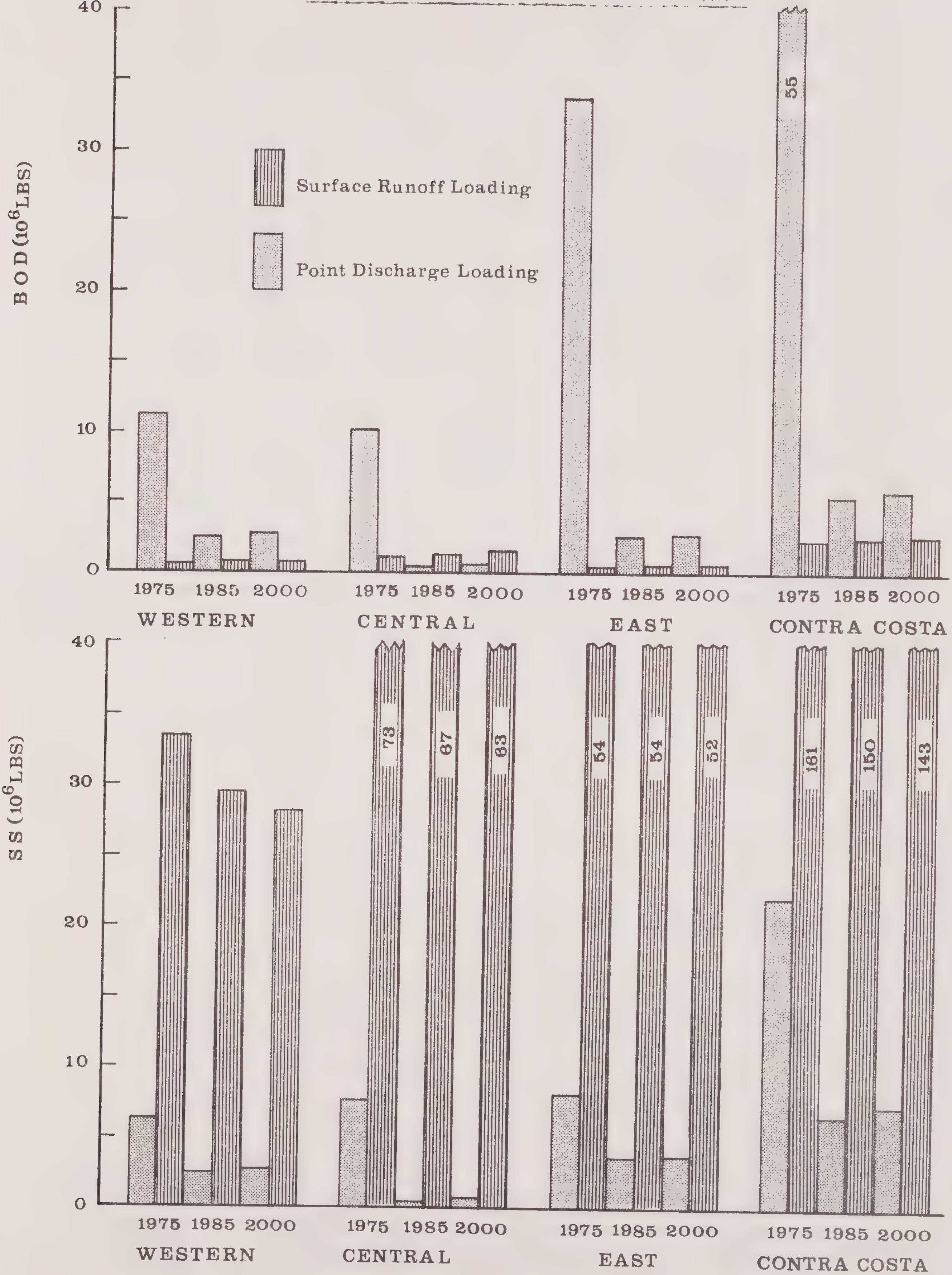
TABLE A - 9 (continued)

SUMMARY OF POINT AND SURFACE
RUNOFF LOADINGS TO BAY-DELTA

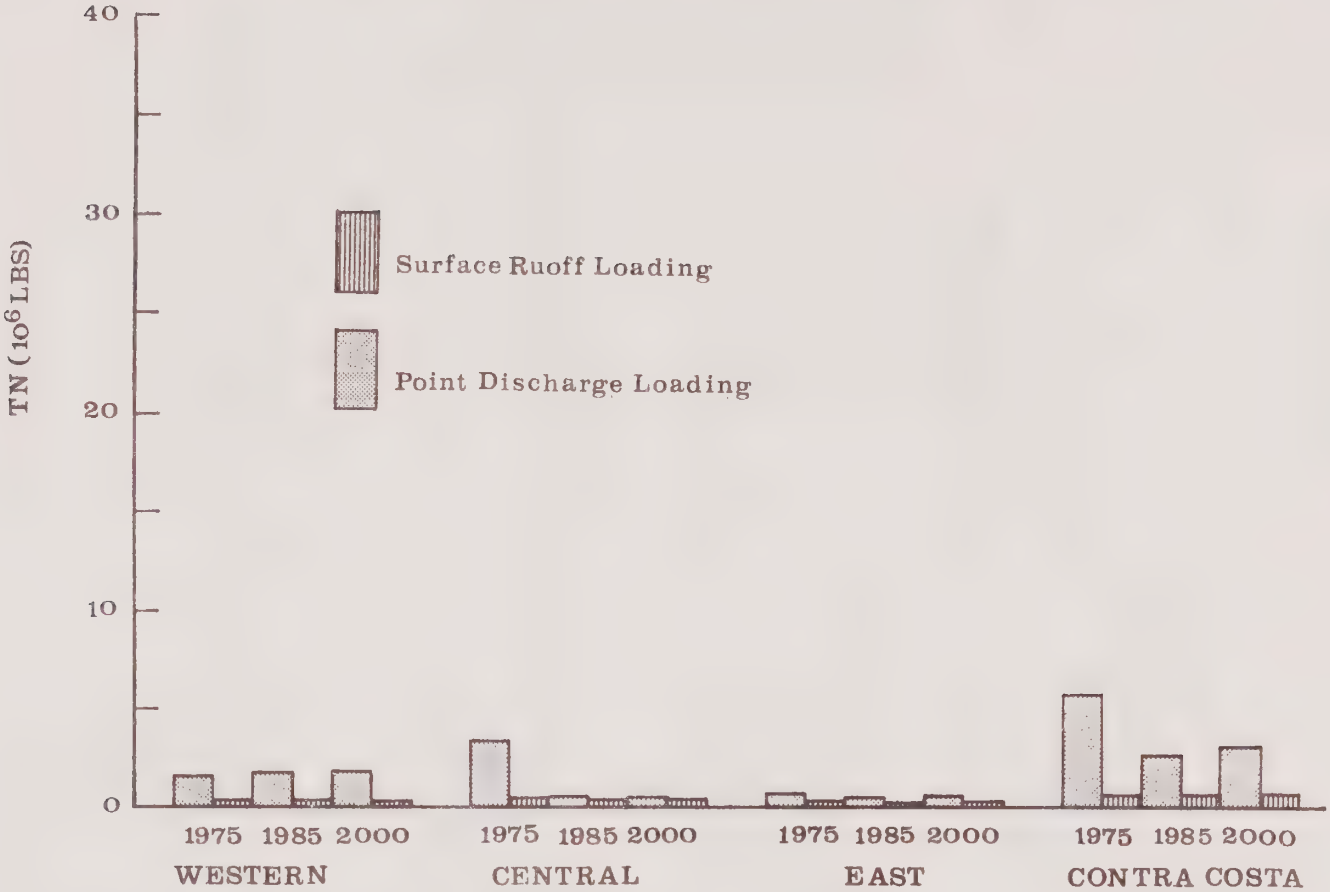
(In Thousands of Pounds)

2000	BOD	(%)	SS	(%)	TN	(%)	TP	(%)
WEST								
Municipal	1860	(21)	1860	(1)	1574	(41)	1197	(40)
Industrial	850	(10)	847	(1)	347	(9)	7	(0)
Point	2710	(31)	2707	(2)	1921	(50)	1204	(40)
Surface	845	(10)	28245	(19)	224	(6)	29	(1)
Total	3555	(41)	30952	(21)	2145	(56)	1233	(41)
CENTRAL								
Municipal	266	(3)	133	(0)	266	(7)	1329	(44)
Industrial	234	(3)	566	(0)	195	(5)	0	(0)
Point	500	(6)	699	(0)	461	(12)	1329	(44)
Surface	1351	(15)	62604	(42)	382	(10)	52	(2)
Total	1851	(21)	63303	(42)	843	(22)	1381	(46)
EAST								
Municipal	825	(9)	825	(0)	550	(14)	274	(9)
Industrial	1953	(22)	3017	(2)	75	(2)	75	(3)
Point	2778	(32)	3842	(2)	625	(16)	349	(12)
Surface	558	(6)	51887	(35)	194	(5)	28	(1)
Total	3336	(38)	55729	(37)	819	(21)	377	(13)
Total Point	5988	(69)	7248	(5)	3007	(79)	2882	(96)
Total Surface	2754	(31)	142736	(95)	800	(21)	109	(4)
TOTAL	8742	(100)	149984	(100)	3807	(100)	2991	(100)

SURFACE RUNOFF & POINT SOURCE LOADINGS



SURFACE RUNOFF & POINT SOURCE LOADINGS



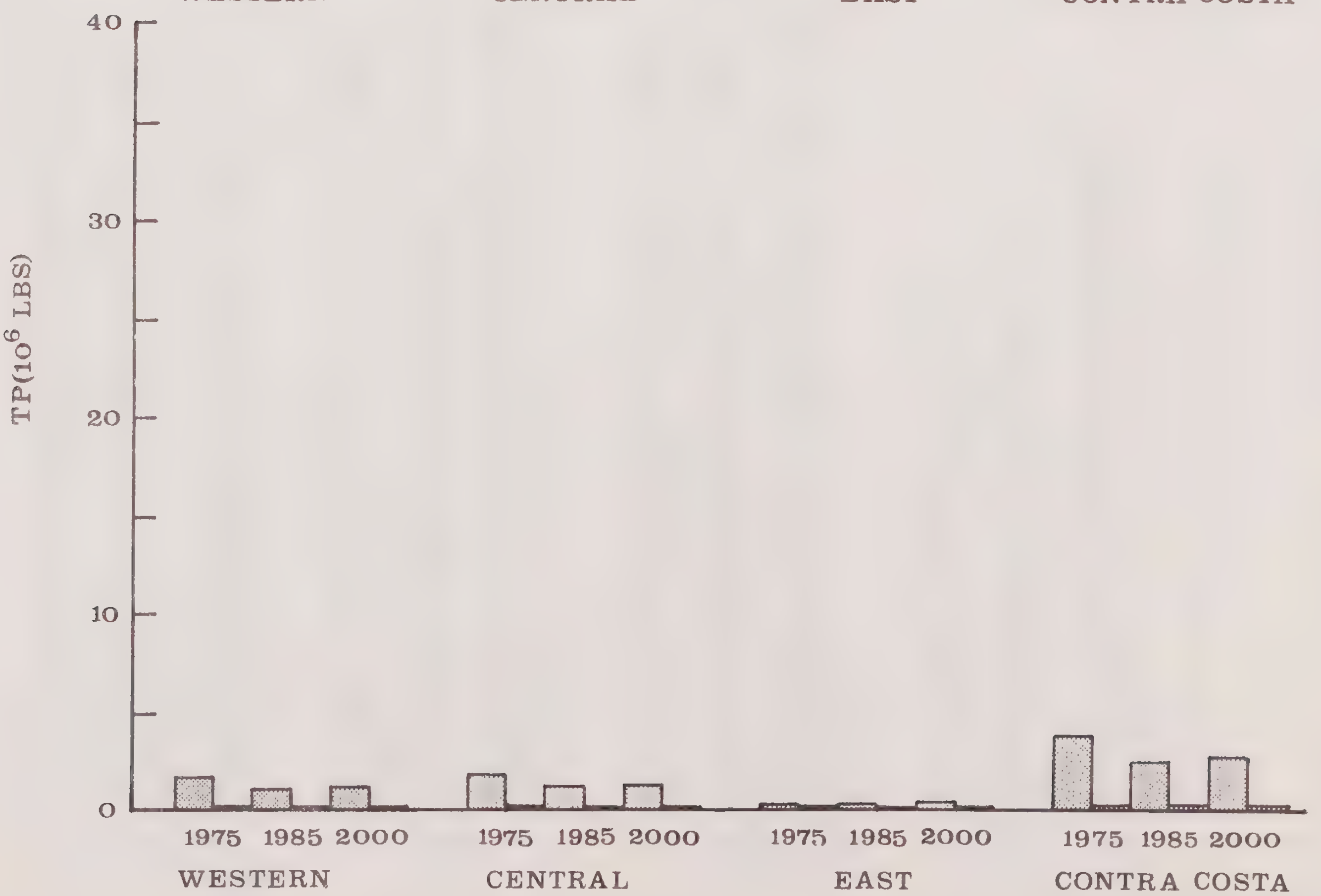


TABLE A-10

ANNUAL POLLUTANT LOADS IN POUNDS PER ACRE

		1975				1985				2000			
WATERSHED		BOD	SS	TP	TN	BOD	SS	TP	TN	BOD	SS	TP	TN
1. Marsh Cr.	A	1.89	374	0.13	0.94	1.87	374	0.13	0.94	1.89	374	0.13	0.94
	B	1.58	238	0.12	0.69	1.58	236	0.12	0.69	2.39	221	0.12	0.81
2. Kellogg		1.88	374	0.15	0.95	1.90	374	0.15	0.95	1.92	373	0.15	0.95
3. Walnut Cr.	B	5.23	580	0.35	1.96	6.39	514	0.35	2.10	6.82	477	0.30	2.15
	C	17.02	507	0.59	4.45	18.73	474	0.62	4.77	20.29	445	0.65	5.07
4. Diablo	B	3.87	548	0.25	1.64	4.02	528	0.25	1.64	5.07	491	0.25	1.79
	C	3.65	553	0.29	1.60	3.65	552	0.29	1.60	3.79	548	0.29	1.60
5. Alhambra	A	3.09	562	0.28	1.40	3.93	503	0.28	1.54	4.07	490	0.28	1.54
	B	9.21	435	0.61	2.46	15.36	324	0.61	3.69	17.81	254	0.61	4.30
	C	11.02	417	0.44	2.94	10.73	406	0.44	2.94	12.64	399	0.44	3.23
6. San Pablo	A	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
	B	10.21	716	0.49	3.28	13.25	571	0.49	3.65	14.22	515	0.49	3.77
	C	15.94	525	0.59	4.25	17.48	499	0.59	4.49	18.07	491	0.59	4.61
9. Pinole	A	4.08	765	0.29	1.93	5.15	671	0.29	2.07	5.22	656	0.29	2.07
	B	8.39	528	0.39	2.60	11.76	423	0.39	3.18	12.82	384	0.39	3.28
12. Antioch	A	2.07	399	0.16	0.95	2.54	368	0.16	1.11	3.18	336	0.16	1.11
	B	1.82	304	0.20	0.81	2.02	295	0.20	0.81	3.23	253	0.20	1.01
	C	9.93	346	0.38	2.64	10.43	328	0.38	2.76	14.70	277	0.50	3.64
13. W.Pittsburg	A	2.59	389	0.13	1.17	2.33	388	0.13	1.04	2.59	384	0.13	1.04
	C	7.59	385	0.31	2.22	8.21	369	0.31	2.34	9.81	340	0.37	2.65
16. Richmond	C	28.37	571	0.97	7.05	29.01	551	0.97	7.13	29.91	542	0.97	7.37

THE STORM WATER MANAGEMENT & MODEL (SWMM)

SWMM is a site specific model designed to analyze in detail the responses of relatively small watersheds to varying hydrologic occurrences and the character of stormwater runoff with a variety of control measures imposed. As with any model the controlling factors are the basic assumptions or technical hypothesis used to develop the model and the basic data input used for model runs.

Because of time constraints and a limited budget, only one SWMM demonstration watershed was examined, that being the Pine-Galindo Watershed consisting of approximately 18,000 acres. The criteria for selection of demonstration watersheds was set forth by ABAG and the application of that criteria for Pine-Galindo is as follows:

Criteria	Rating of Pine-Galindo Watershed
1. Local Significance	
a. Beneficial Use Areas:	Potential water-oriented recreation and/or fresh water habitat.
b. Growth Areas:	Change from Ag and Open Space to Residential.
c. Problem Areas:	Drainage into Contra Costa Canal and Sedimentation.
d. Control Measure Testing Areas:	Control measures applicable to residential subdivisions, commercial, and light industrial areas.
2. Results Applicable to Unmodeled Watersheds	
a. Watershed Size:	Typical for Contra Costa County.
b. Types of Control Measures Tested:	Variety can be tested.
3. Model Result Reliability	
a. Streamflow Data	County Flood Control has stream stage recorder.
b. Water Quality Data	None.

c.	Rainfall Data	USWS raingauge at Walnut Creek - 3-1/2 miles west of centroid of watershed.
d.	Suitability to Water Quality Sampling Program.	Good, discrete upstream sites can be selected for detailed analysis.

Some 300 man-hours were expended in compiling the necessary basic data, making computer runs and analyzing the results of the computer runs. Due to insufficient flow data, water quality data, some basic model deficiencies, and the absence of data relating to the effectiveness of control measures to have been examined, the use of SWMM was terminated for this study. The basic data developed for SWMM is reported in Appendix C.

APPENDIX B

MONITORING PROGRAM

SUPPORTING DATA

CONTENTS

Included in this Appendix is a description of the monitoring program as originally envisioned, descriptions of most of the watersheds in which monitoring occurred, and the monitoring results. Also included is similar data for a small watershed within the City of Richmond which was selected and monitored by ABAG staff.

Remarks contained herein pertaining to recommendation for continued monitoring are promised on the condition that further research on storm water runoff quality characteristics may be necessary. The stations identified are technically satisfactory for this purpose. The recommendations are not to be construed as a policy recommendation for continued monitoring.

Contra Costa County
FLOOD CONTROL
& Water Conservation District

VERNON L. CLINE
ex officio Chief Engineer

J. E. TAYLOR, Deputy Chief Engineer
255 Glacier Drive, Martinez, Cali[illegible] [illegible]53
Telephone (415) 3[illegible] [illegible]470

SURFACE RUNOFF MANAGEMENT PLAN

WATER QUALITY MONITORING PROGRAM

A. Introduction

The water quality monitoring program for surface runoff within Contra Costa County has two major objectives:

1. To better determine the magnitude, timing and character of the pollutant loading from surface runoff upon the receiving waters, and

2. To provide the technical data required for the calibration of the mathematical models to be used in evaluating the potential effectiveness of various possible control measures in reducing the impact of surface runoff pollutants upon the receiving waters.

The only known monitoring of surface runoff quality presently being performed is by the East Bay Municipal Utility District on San Pablo Creek as it enters San Pablo Reservoir. Little historical information or data on the quality of Contra Costa County creeks and streams is available.

B. Program Description

1. General

The program consists of the collection of samples of streamflow at pre-selected locations during periods of storm water runoff; the chemical analysis of these samples (or a representative portion thereof) for specific water quality parameters; and the acquisition of pertinent streamflow, rainfall, and soil moisture records.

B. Program Description

2. Monitoring Stations

Two control stations have been selected for monitoring during all storms. Additional stations have been selected for monitoring during individual storms.

The control stations are:

Walnut Creek @ Diamond Boulevard Bridge (WC)

This is the lowest point on Walnut Creek not influenced by a known point discharge (Concord Wastewater Treatment Plant). Approximately 60,000 acres are drained to this point and the drainage area encompasses heavily developed, rapidly developing, and permanent open space areas. The nearest stream gage is the Walnut Creek @ Monument USGS gage approximately 1 3/4 miles upstream. Accretions between the gage and the monitoring station will be calculated.

Pine Creek @ Market Street (PC-1)

Approximately 18000 acres are drained through Pine and Galindo Creeks to this station. The drainage area is representative of central county development.

The remaining stations which will be monitored for one storm event only are;

San Ramon Creek @ Bolinger Canyon Road (SRB)

Representative of drainage from undeveloped lands and representative of the base or background water quality levels for Walnut Creek.

2. Monitoring Stations

San Ramon Creek @ Rudgear Road (SRW)

Representative of drainage from large lot development and rapidly developing areas.

Rheem Creek @ San Pablo Boulevard (RC)

Representative of high density residential development within a markedly different watershed.

Marsh Creek upstream of Reservoir (MCR)

Representative of undeveloped range land and a markedly different watershed.

Marsh Creek @ Cypress Road (MCC)

Representative of drainage from irrigated agricultural operations.

Flood Control Office at Martinez

This station will be utilized for collection of rainfall samples for the first two or three storm events.

In addition it is proposed to monitor one or more specific storm drains within the Pine-Galindo watershed which service either predominately commercial or residential areas. The decision to monitor specific drains will be made after review of initial monitoring results from this and other bay-area counties.

3. Monitoring Schedule and Mobilization

Storm Event #1

Crew #1 WC, PC-1

Crew #2 SRB, SRW
Hurley Rainfall

Storm Event #2

Crew #1 WC, PC-1

Crew #2 RC
Hurley Rainfall

Storm Event #3

Crew #1 WC, PC-1

Crew #2 MCR, MCC
(Alternative - Pine Creek Storm Drains)

National Weather Bureau forecasts are received twice daily. In addition quantitative precipitation forecasts (QPF) by the State Department of Water Resources are received twice daily. Crews will be alerted for possible duty based upon these forecasts. The Program Supervisor, based upon observations in the Martinez, Antioch, and Alamo areas will mobilize crews when precipitation occurs and there is a reasonable prospect of sufficient runoff occurring to be measured at the monitoring stations.

4. Quality Parameters

For each monitoring station and each storm event samples will be collected and analyzed for:

CORE

BOD_5

Suspended Solids

Volatile Suspended Solids

Dissolved Solids

Total N (separated to NO_2, NO_3, and Kjeldahl Nitrogen)

Total P

Lead

In addition samples will be taken at one of the control stations during the second and fourth storm events and be analyzed for:

SPOT

COD

Fecal Coliform

Total Coliform

Zinc *

Cadmium *

Copper *

* Composite Samples

5. <u>Organization</u>

Program Coordinator - Oliver Smith

Program Supervisor - Lou Hurley

Paul Wu (back-up)

Sampling Team Members (Two per team)

As available: Rich Bruno

Steve Buckmann

Brian Stockinger

Reece Welch

Miner Ashcraft

Rune Marken

Larry Shirkey

Paul Summa

The program supervisor will be responsible for acquisition of materials and equipment, alerting and mobilizing sampling teams, transporting samples to laboratory, collection of rainfall samples and trouble shooting.

The sampling crews will be responsible for taking sample, preservation of samples, record keeping, reading of streamflow recorders and staff gages.

The program coordinator will be responsible for obtaining services of laboratory, general organization and administration and transportation arrangements.

All personnel will participate in one training session. Coordinator and supervisors will also be available as backup to the sampling crew.

6. <u>Budget</u>

Labor Rates

Tech III	$16.95/hr.	
	19.95/hr. O.T.	($160/8 hrs. O.T.)
Tech IV	$19.37/hr.	
	22.95/hr. O.T.	($184/8 hrs. O.T.)
Asst. C.E.	$20.67/hr.	
	24.65/hr. O.T.	($197/8 hrs. O.T.)
E.C.E.	$25.34/hr.	($203/8 hrs.)

Assumptions

a. Each storm event will require 8 hours crew time

b. Each storm event will occur during O.T. periods

c. Basic crew (Tech III's and Asst. C.E.) will work each event.

d. Six streamflow samples per storm event per station will be analyzed

e. Two rainfall samples per designated storm event will be analyzed for core parameters less BOD5

Lab Analysis Costs

Core parameters	$71.80 per set
Spot check parameters	57.80 per set
Rainfall	55.40 per set

Equipment and Materials

4 - Cased Thermometers	15	60
4 - pr. Hip Waders	30	120

6. Budget

Equipment and Materials (Con'd)

6 - Raingear	20	120
500 LF 5/16 Nylon Rope	0.10	50
6 - Lanterns w/Batt.	15	90
6 - Waterproof Marking Pen	1	6
2 - First Aid Kits	15	30
4 doz. 20 gal. Plastic Bags.	2	8
1 - 10' x 20' 4 mil. Polyethylene		8
1 - Funnel	1	1
3 - Bucket	4	12
1 - Rain Collector		50
2 - Safety Belts	40	80
		$635

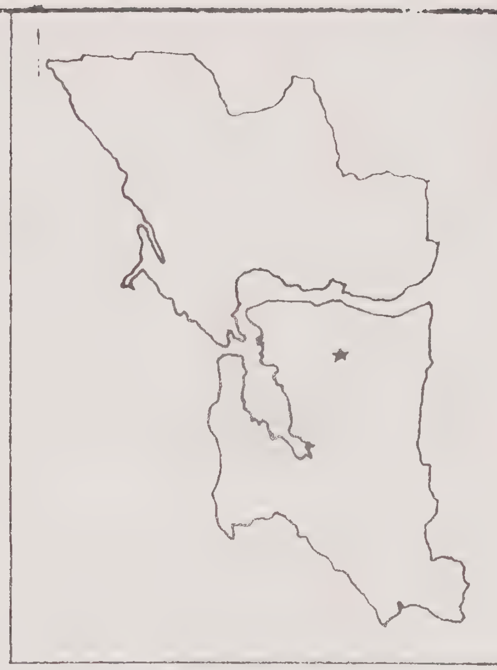
Training

4 hours each for 5 Tech. III	339
2 Tech. IV	155
2 Asst. C.E.	165
1 E.C.	86
	$745

6. Budget

	Labor	Lab	Total	Cum. Total
Equipment & Training	$745	$ 635	$1490	$1490
Storm Event #1	837	1400	2237	3727
#2	837	1746	2583	6310
#3	837	1290	2127	8437

Depending upon funds remaining out of the $10,000 budgeted for monitoring either a fourth event will be monitored or additional analysis of preserved samples will be made for heavy metals.



1 San Ramon Cr @ San Ramon
2 San Ramon Cr @ Walnut Cr
3 Walnut Cr @ Diamond Blvd.
4 Pine Cr @ Market

Legend

★ Sampling site
R Hourly Rain Guage
G Stream Guage

WALNUT CREEK
WATERSHED

SAN RAMON CREEK WATERSHED @ SAN RAMON

DATA COLLECTION	Quality data was collected by Contra Costa County Flood Control District Staff at the gauge site. Flow data derived from U.S.G.S. gauge located 0.2 mile downstream, from Bollinger Creek.
WATERSHED SIZE	5.89 sq.mi. (15 sq.km.)
DESCRIPTION	The San Ramon Creek watershed is located in southern Contra Costa County. Most of the watershed is steeply sloping terrain. The total relief is 1400 ft (426m).
LAND USE	The drainage area encompasses mainly open space with scattered single family residential sites.

	Residential	Commercial	Industrial	Open	Ag
Acres	200			3800	
%	5%			95%	

STORMS SAMPLED February 21

FLOW MEASUREMENTS	Flow measurements were recorded from USGS recorder by Contra Costa County personnel.
SAMPLE ANALYSIS	Samples were collected by Contra Costa County staff manually. All analyses were performed by LFE Laboratories.
OBSERVATIONS DURING SAMPLING	None
COMMENTS	This is the best example of open space monitoring in this county. Continued monitoring is recommended.

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION San Ramon @ San Ramon [S][R]
3. STORM NUMBER [0][1]
4. DATE OF SAMPLES [0][2][2][1][7][7]

5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF 0615

	CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
Gage	UNITS →				INCHES	CFS	°F C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1.82		SRB1		0705	.	1.19	12.	.		6.3		1.0	.86	.64	120	24	580	.07
1.96		SRB2		1135	.	3.47	12.	.		8.0		2.5	.61	.69	300	50	440	.03
1.84		SRB3		1540	.	1.42	.	.		4.2		1.8	.93	.38	110	22	430	.02

SAN RAMON CREEK WATERSHED @ WALNUT CREEK

DATA COLLECTION

Quality data was collected by Contra Costa County Flood Control District staff at the gauge site.

Flow data was derived from the USGS gauge located 600 ft. upstream from Rudgear Road near South City limits of Walnut Creek.

WATERSHED SIZE

47.9 sq. mi. (124 sq. km.)

DESCRIPTION

The San Ramon Creek watershed is located in central Contra Costa County and includes Alamo & the Danville Area. With the exception of the heavily developed areas near Highway 680 (which are gently sloping), most of the watershed is characterized by moderate to very sleeply sloping terrain. The total relief is 1850 ft (563 m).

LAND USE

The drainage area encompasses heavily developed, rapidly developing and permanent open space area.

About one-third of the area is urbanized consisting mainly of single family residentual, commercial & industrial development.

	Residential	Commercial	Industrial	Open	Ag
Acres	5500	2045	50	21400	1000
%	18%	6.8%	0.2	72	3.

STORMS SAMPLED

February 21, 1977

FLOW MEASUREMENTS	Flow measurements were recorded from USGS stage recorder by Contra Costa county personnel.
SAMPLE ANALYSIS	Samples were collected by Contra Costa County staff manually. All analyses were performed by LFE Laboratories.
OBSERVATIONS DURING SAMPLING	None
COMMENTS	This station is recommended for further monitoring as an example of a developing area.

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION San Ramon @ Walnut Cr. [R][U]
3. STORM NUMBER [0][1]
4. DATE OF SAMPLES [0][2][2][1][7][7]
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

Gage	CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD5	COD	K-N	NO_2 + NO_3	TOTAL P	SS	V.SS	TDS	LEAD
	UNITS →				INCHES	CFS	°~~F~~C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1.88		SRR1		0945	.	76.4	13.5	.	~~10~~	10.0		1.5	1.2	.57	170	25	550	.08
1.90		SRR2		1220	.	79.1	12.5	.		7.2		1.2	.85	.26	76	12	570	.07
1.63		SRR3		1510	.	47.8	.	.		7.2		1.4	.82	.46	150	22	570	.05

WALNUT CREEK WATERSHED @ CONCORD

DATA COLLECTION

Quality data was collected by Contra Costa County Flood Control District staff at the Diamond Boulevard bridge. Flow data was derived from the USGS gauge at Monument Boulevard.

WATERSHED SIZE

94 sq. mi. (243 sq. km.)

DESCRIPTION

The Walnut Creek watershed is located in central Contra Costa County and includes the cities of Walnut Creek, Lafayette and Pleasant Hill. With the exception of the heavily developed areas near Highway 24 and 680 (which are gently sloping to nearly level), most of the watershed is characterized by moderate to very steeply sloping terrain. The total relief is 1950 ft. (593 m).

LAND USE

The drainage area encompasses heavily developed, rapidly developing and permanent open space area. About half of the watershed is urbanized. Of this, approximately 70% is single family residential; the remaining 30% is commercial, industrial and multifamily residential. The open areas consist primarily of range land and grassland on the steeper portions of the watershed.

	Residential	Commercial	Industrial	Open	Ag
Acres	12480	2385	1121	44014	
%	20.8%	4.0%	1.9%	73.4%	

STORMS SAMPLED

February 8, 21 March 15, 16, 23

FLOW MEASUREMENTS	Flow measurements were recorded from USGS stage recorder at Monument Blvd. (approximately 2 miles upstream) by Contra Costa County personnel.
SAMPLE ANALYSIS	Samples were collected by Contra Costa County staff manually. All analyses were performed by LFE Laboratories.
OBSERVATIONS DURING SAMPLING	None
COMMENTS	It is recommended that monitoring be continued at this station.

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION Walnut Cr. @ Diamond [W][C]
3. STORM NUMBER [0][0]
4. DATE OF SAMPLES [0][2][0][8][7][7]

5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

Gage 3.21

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	WCC		1640	.	33.6	.	.		5.7		.24	4.33	.31	76	33	520	.05

B-21

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION Walnut Cr @ Diamond [W C]
3. STORM NUMBER [0 1]
4. DATE OF SAMPLES [0 2 2 1 7 7]
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	NO_2 + NO_3	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°F/°C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	WC1		1040	.	145	.	.		11		1.7	1.3	.56	190	26	2500	.18
	WC2		1255	.	160	13.5	.		11		1.6	1.1	.56	140	24	310	.15
	WC3		1429	.	137	.	.		7.4		1.4	.88	1.5	120	19	320	.08

Gage

WATER QUALITY DATA REPORTING FORM

CARD #1

1. COUNTY *Contra Costa* 2
2. MONITORING STATION *Walnut Creek @ Diamond* W C
3. STORM NUMBER 0 2
4. DATE OF SAMPLES 0 3 1 5 7 7

5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF ______

Gage	CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
	UNITS →				INCHES	CFS	°C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
3.80		WC4		1945	.	170.1	12.0	.		9.4		1.2	1.53	.49	140	26	350	
3.85		WC5		2030	.	187.0	12.0	.		3.6		1.4	1.42	.42	250	31	240	

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	WC4		1.2E5	4.6E4	. E											
	WC5		1.1E5	1.5E4	. E											

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY *Contra Costa* [2]
2. MONITORING STATION *Walnut Creek @ Diamond* [W][C]
3. STORM NUMBER [0][2]
4. DATE OF SAMPLES [0][3][1][6][7][7]

5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

Gage 4.01

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	WC6		0115	.	246.5	.	.										
				.		.	.										
				.		.	.										
				.		.	.										
				.		.	.										

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM ~~mg/e~~	CHROMIUM ~~mg~~	MERCURY ~~mg~~	SILVER	ARSENIC	COPPER ~~mg~~	ZINC mg	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100ml	MPN/100ml	MPN/100ml	~~mg~~/l	~~mg~~/l	µg/l	ug/l	ug/l	mg/l	mg/l	ug/l	umhos	mg/l	mg/l
	WC6		1.1E5	2.4E4	.E	.02	.02	1			.01	.06				
			.E	.E	.E											
			.E	.E	.E											
			.E	.E	.E											
			.E	.E	.E											

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY *Contra Costa* [2]
2. MONITORING STATION *Walnut Creek @ Diamond* [W][C]
3. STORM NUMBER [0][3]
4. DATE OF SAMPLES [0][3][2][3][7][7]
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

Gage .3.25

CARD	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	PH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	WC7		1200	.	39.1	15.	.		13		.1	.86	.22	6	3.2	600	
				.		.	.										
				.		.	.										
				.			.										

CARD	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	WC7		1.1E3	2.4E2	. E											
			. E	. E	. E											
			. E	. E	. E											
			. E	. E	. E											
			. E	. E	. E											

CARD #2

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION Walnut Creek @ Diamond [W][C]
3. STORM NUMBER [ ][13]
4. DATE OF SAMPLES [0][4][1][1][7][7]

5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ____ INCHES
7. TIME AT START OF RUNOFF ______

CARD	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	WCD		1.1E3	1.5E1	. E											
	WCLF		1.5E3	2.4E2	. E											

13-26

PINE CREEK WATERSHED

DATA COLLECTED	Data was collected by Contra Costa Flood Control District staff.
WATERSHED SIZE	28 sq.mi. (73 sq. km.)
DESCRIPTION	The Pine Creek watershed is located in central Contra Costa Company on the western slopes of Mt. Diablo. The sampling site is located on Pine Creek at Market Street in Concord (3/4 mile northwest of the junction of Highways 680 and 24). Most of the watershed is steeply sloping, with the exception of the lowermost portion in the City of Concord. Elevations range from about 3000 ft. (915 m) near the top of Mt. Diablo to about 60 ft. (18 m) in Concord.
LAND USE	The drainage area is representative of central county development.

	Residential	Commercial	Industrial	Open	Ag
Acres	4200	200	200	13.300	
%	23%	1.1 %	1.1	74%	

STORMS SAMPLED	February 8, 21	March 15, 16

FLOW MEASUREMENTS	Flow measurements were recorded and calibrated by Contra Costa County personnel.
SAMPLE ANALYSIS	Samples were collected by Contra Costa County staff manually. All analyses were performed by LFE Laboratories.
OBSERVATIONS DURING SAMPLING	None
COMMENTS	This station should be continued for quality and quantity monitoring. Consideration should be given to relocation of this station to a more uniform hydraulic section.

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION Pine Creek @ Market [P M]
3. STORM NUMBER [0 0]
4. DATE OF SAMPLES [0 2 0 8 7 7]

5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF ______

Gage 0.08

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	00C		1455	.		.	.		18		.72	6.60	.40	150	27	400	.31

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION Pine Cr @ Market [P][M]
3. STORM NUMBER [0][1]
4. DATE OF SAMPLES [0][2][2][1][7][7]
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

	CARD	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	NO_2 + NO_3	TOTAL P	SS	VSS	TDS	LEAD
Gage	UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		P01		1000						14		2.4	1.5	.56	220	39	260	.26
0.15		P02		1200						10		2.3	1.3	.54	300	37	220	.01
* 0.75		P03		1300						10		1.7	1.4	.48	310	35	200	.11
1.00		P04		1400						15		2.5	1.22	.63	450	67	190	.52
0.85		P05		1500						13		3.0	1.84	1.9	710	88	250	.33
0.55		P06		1600						11		2.8	1.46	.46	500	59	2300	.25

* Peak @ 1340 @ 1.06'

13.31

WATER QUALITY DATA REPORTING FORM

CARD #1

1. COUNTY Contra Costa [2]
2. MONITORING STATION [P][M]
3. STORM NUMBER [0][2]
4. DATE OF SAMPLES [0][3][1][6][7][7]

5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

Gage 1.6

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD$_5$	COD	K-N	NO$_2$ + NO$_3$	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	P10		0100														

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100ml	MPN/100ml	MPN/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	P10		4.6E4	4.6E4		.02	.02									
								1			.01	.005				

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY *Contra Costa* [2]
2. MONITORING STATION *Pine Creek @ Market St* [P][M]
3. STORM NUMBER [0][2]
4. DATE OF SAMPLES [0][3][1][5][7][7]
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

13 32

Gage	CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	NO_2 + NO_3	TOTAL P	SS	VSS	TDS	LEAD
	UNITS →				INCHES	CFS	°F/C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		P07		1515	.		12.0	.		14		.32	2.13	.18	100	20	620	
0.0		P08		1815	.		11.0	.		12		.1	1.52	.42	230	36	230	
0.40		P09		2000	.		11.0	.		14		.16	1.52	.44	140	5	250	

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	P07		7.5E4	2.4E3	. E											
	P08		2.4E6	2.0E4	. E											
	P09		1.2E5	2.4E4	. E											

WATER QUALITY DATA REPORTING FORM

CARD #1

1. COUNTY Contra Costa [2]
2. MONITORING STATION Pine Cr @ Market [P][M]
3. STORM NUMBER [0][3]
4. DATE OF SAMPLES [0][3][2][3][7][7]

5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

CRD	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	P10		1210						19		.1	2.91	.02	10	2	800	

CRD	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	P10		4.6E3	9.3E2												

CARD #2

WATER QUALITY DATA REPORTING FORM

1. COUNTY *Contra Costa* | 2 |
2. MONITORING STATION *Pine Cr. @ Market* | P | M |
3. STORM NUMBER | C | E |
4. DATE OF SAMPLES | 0 | 4 | 1 | 1 | 7 | 7 | (6 7 8 9 10 11)

5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ____ INCHES
7. TIME AT START OF RUNOFF ______

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CAD-MIUM	CHROMI-UM	MER-CURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUC-TIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
12	13 14 15 16	17	18 19 20 21 22	23 24 25 26 27	28 29 30 31 32	33 34 35 36	37 38 39 40	41 42 43 44	45 46 47 48	49 50 51 52	53 54 55 56 57	58 59 60 61 62	63 64 65 66	67 68 69 70	71 72 73 74 75	76 77 78 79 80
	PMD		1.1E3	1.1E3	. E											
			. E	. E	. E											
	PMLF		4.6E2	2.4E2	. E											
			. E	. E	. E											
			. E	. E	. E											
			. E	. E	. E											
			. E	. E	. E											
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			. E	. E	. E											

B-34

GALINDO CREEK WATERSHED
(Upper Portion)

DATA	Data was collected by Contra Costa County Flood Control District staff at Galindo Creek and Ygnacio Valley Road. There is no flow gage on Galindo Creek.
WATERSHED SIZE	2.7 square miles (7 sq. km)
DESCRIPTION	The upper portion of Galindo Creek Watershed is located in Central Contra Costa County on the northern slopes at Mt. Diablo. The total relief is approximately 820 feet (286 m).
LAND USE	The monitored portion of the watershed is 95% open space and undeveloped.
STORMS SAMPLED	March 24, 1977

FLOW MEASUREMENTS	No flow measurements were recorded. Flow was barely sufficient to enable sample to be taken.
SAMPLE ANALYSIS	A sample was collected by Contra Costa County staff manually. Analyses was performed by LFE Laboratories.
OBSERVATIONS DURING SAMPLING	None
COMMENTS	No comment.

LITTLE PINE CREEK WATERSHED

DATA COLLECTION	Quality data was collected by Contra Costa County Flood Control District staff at the gauge site. Flow data derived from USGS gauge located just upstream from the junction with Pine Creek.
WATERSHED SIZE	1.6 sq. mi. (4 sq. km.)
DESCRIPTION	The Little Pine Creek watershed is located in central Contra Costa County on the western slopes of Mt. Diablo. Most of the watershed is in steeply sloping terrain. The total relief is approximately 2300 ft. (702 m)
LAND USE	The drainage area encompasses mainly open space with a scattered few single family residential sites.

	Residential	Commercial	Industrial	Open	Ag
Acres				1000	
%				100%	

STORMS SAMPLED	March 24

FLOW MEASUREMENTS	Flow was insufficient to be recorded on the USGS stage recorder at this location.
SAMPLE ANALYSIS	Sample was collected by Contra Costa County staff manually. Analysis was performed by LFE Laboratories.
OBSERVATIONS DURING SAMPLING	None
COMMENTS	This station is a reasonable example of open space and continued monitoring is recommended.

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa [2]
2. MONITORING STATION GA = Galindo, LP = Little Pine [ ] [M]
3. STORM NUMBER [0][3]
4. DATE OF SAMPLES [0][3][2][4][7][7]
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	PH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	V.S.S	T.D.S	LEAD
UNITS →				INCHES	CFS	°C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	GA1		1405			12.0			16		6	.50	.08	32	2	910	
	LP1		1430			12.0			9.7		2.6	13.6	2.4	5200	550	380	

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	GA1		2.4E3	2.4E2												
	LP1		1.1E5	2.4E4												

WATER QUALITY DATA REPORTING FORM

CARD #1

1. COUNTY Contra Costa [2]
2. MONITORING STATION Las Trampas @ S. Main [L T]
3. STORM NUMBER [0 1]
4. DATE OF SAMPLES [0 2 2 1 7 7]
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	LT1		1300						5.4		1.8	.45	.150	230	36	150	.17

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
	LT1		E	E	E	.003					.015	.33				

B-40

B-41

WATER QUALITY DATA REPORTING FORM

CARD #1

1. COUNTY *Contra Costa* 2
2. MONITORING STATION *Grayson Cr @ Center* G R
3. STORM NUMBER 0 2
4. DATE OF SAMPLES 0 3 1 5 7 7
5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF ______

CARD #	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	V.SS	TDS	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	GR1		173C						11		1.4	.67	.27	83	18	660	

CARD #	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	ug/l	umhos	mg/l	mg/l
	GR1		1.1E6	4.6E4												

RHEEM CREEK WATERSHED

DATA COLLECTION

Quality data was collected by Contra Costa County Flood Control District staff at the gauge site 50 ft. downstream from the SFRR Bridge. Flow data was derived from the USGS gauge located 50 ft. downstream from the Santa Fe Railway Bridge.

WATERSHED SIZE

1.49 sq. mi. (3.85 sq. km.)

DESCRIPTION

The Rheem Creek watershed is located in western Contra Costa County north of San Pablo in the City of Richmond. The watershed is characterized by moderate sloping terrain. The total relief is 200 ft. (61 ~~mi.~~ m)

LAND USE

The drainage area encompasses mainly single family residential, commercial and some open space adjacent to San Pablo Bay.

	Residential	Commerical	Industrial	Open	Aq
Acres	640	110	20	60	
%	77%	13%	2%	7%	

STORMS SAMPLED

March 15, 1977

FLOW MEASUREMENTS	Flow measurements were recorded from USGS recorder by Contra Costa County personnel.
SAMPLE ANALYSIS	Samples were collected by Contra Costa County staff manually. All analyses were performed by LFE Laboratories.
OBSERVATIONS DURING SAMPLING	None
COMMENTS	This station should be monitored for one normal rainfall season as a good example of a developed area.

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY Contra Costa | 2 |
2. MONITORING STATION Rheem Creek | R | H |
3. STORM NUMBER | 0 | 2 |
4. DATE OF SAMPLES | 0 | 3 | 1 | 5 | 7 | 7 |
5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

Gage	CARD	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	VSS	TDS	LEAD
	UNITS →				INCHES	CFS	°F/C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		RH1		1010														
2.01		RH2		1110		.83	11.5			13		4.7	.68	1.2	73	16	2000	.35
3.00		RH3		1210		35.0	12.0			40		4.1	.68	3.4	130	32	3400	.45
2.90		RH4		1230		29.2	12.0			23		4.6	.60	.65	280	32	3300	.45
										18		3.2	.45	.46	130	22	190	.24

RICHMOND WATERSHED

DATA COLLECTION
Data was collected by ABAG staff. All sampling was manual.

WATERSHED SIZE
2.5 sq. mi. (6.5 sq. km.)

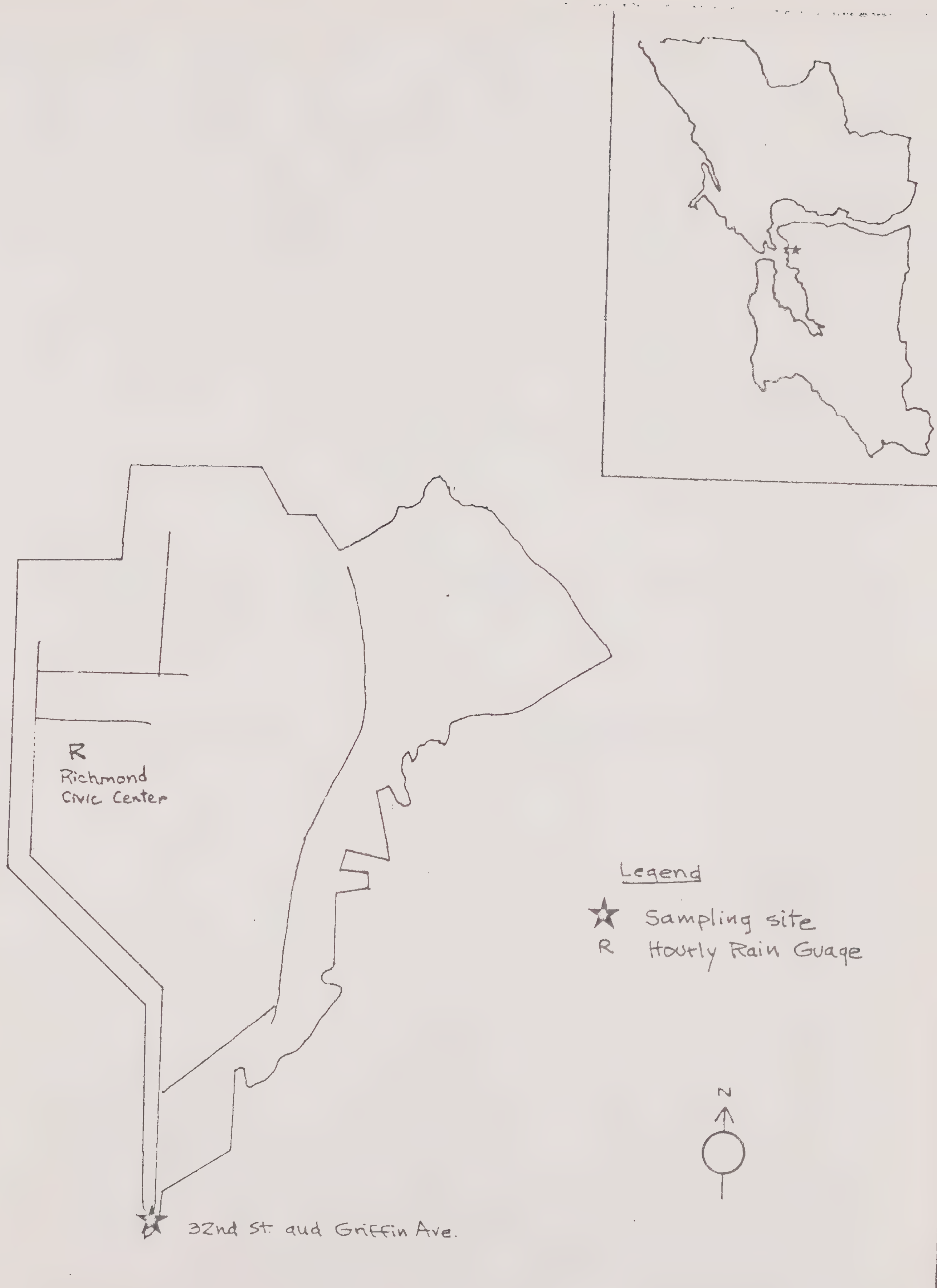
DESCRIPTION
The Richmond watershed is located in the City of Richmond on the western edge of Contra Costa County. Most of the watershed is gently sloping to flat in the lower portion. The northeast corner rises part way into the Berkeley Hills and is moderately steep. The total relief is 385 ft. (117m).

LAND USE
The Richmond watershed is completely urbanized. The middle and upper portions of the watershed are composed of primarily older single family homes on small lots separated by two areas of strip commercial development. The lower end of the area is light industrial. The open area consists primarily of city park land.

	Residential	Commercial	Industrial	Open	Ag
Acres	1204	196	133	57	0
%	76	12	8	4	0

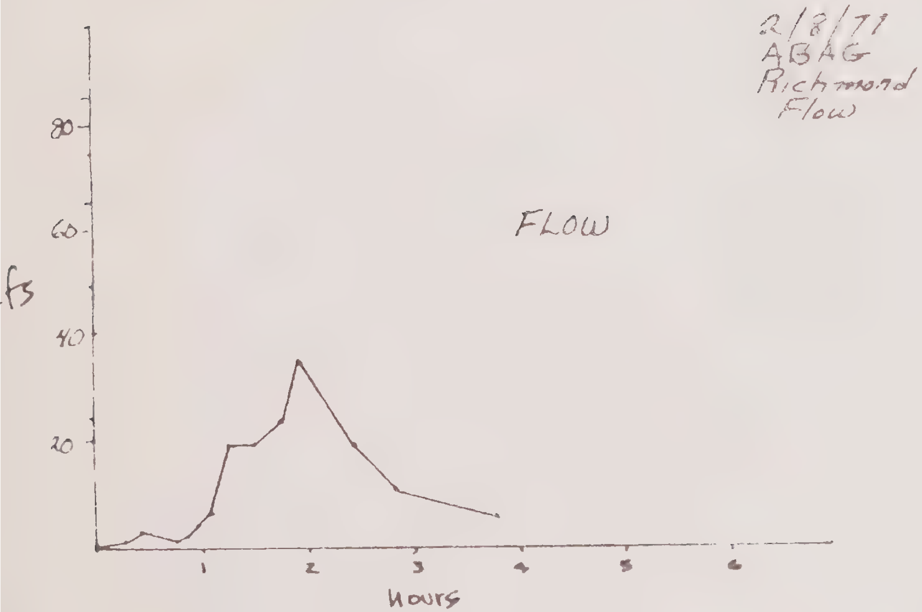
STORMS SAMPLED
February 8, February 10, March 15

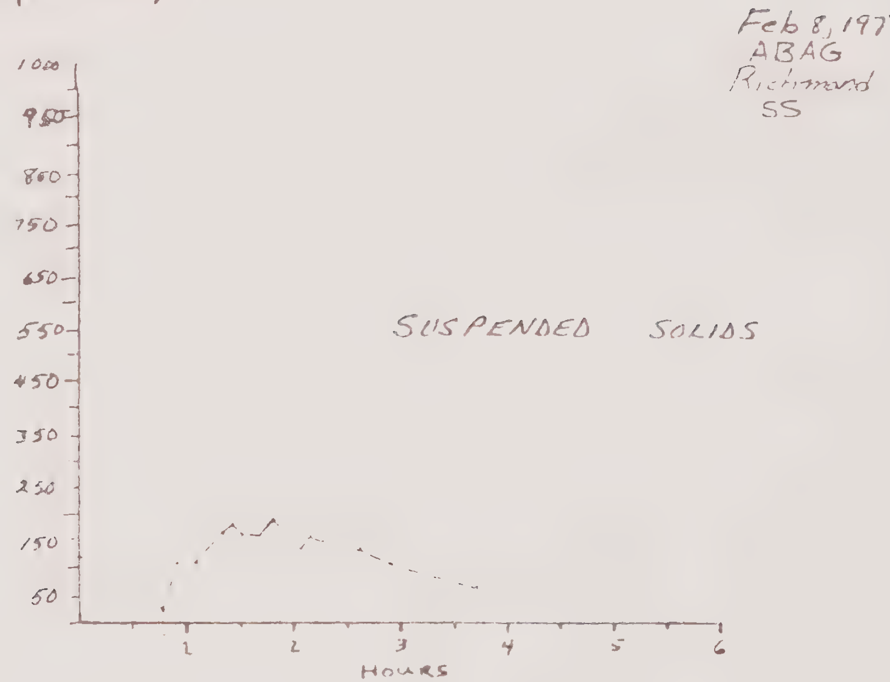
FLOW MEASUREMENTS	Flow data was obtained using a hand-held impeller current meter (on loan from East Bay Municipal Utility District). An average reading was obtained from three measurements across the channel. Gauge height readings were recorded simultaneously in the concrete-lined trapezoidal channel.
SAMPLE ANALYSIS	Water samples were collected manually with an effort made to depth-integrate the samples. Samples were collected in Nalgene labware. Temperature, Dissolved Oxygen and Temperature were measured immediately. Samples were transferred to LFE Laboratories usually within an hour after collection.
OBSERVATIONS DURING SAMPLING	Oil and grease was observed on the surface of the water during the majority of the storm duration. Litter and debris also continued during most of the storm runoff.
COMMENTS	Collection of flow data was very difficult due to the large amount of litter interfering with flow meter operation.

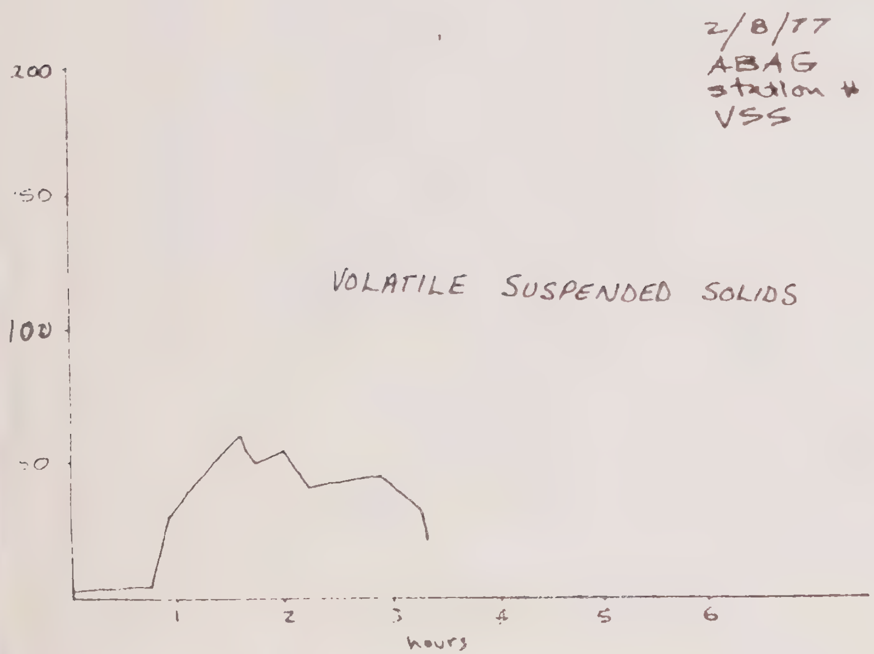


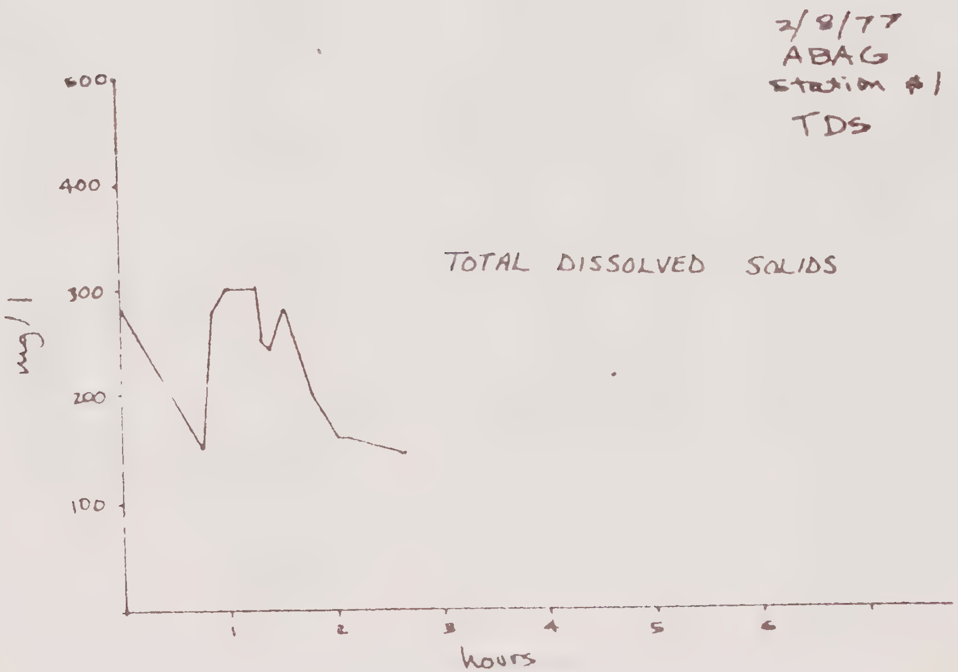
Richmond Watershed

FEBRUARY 8, 1977



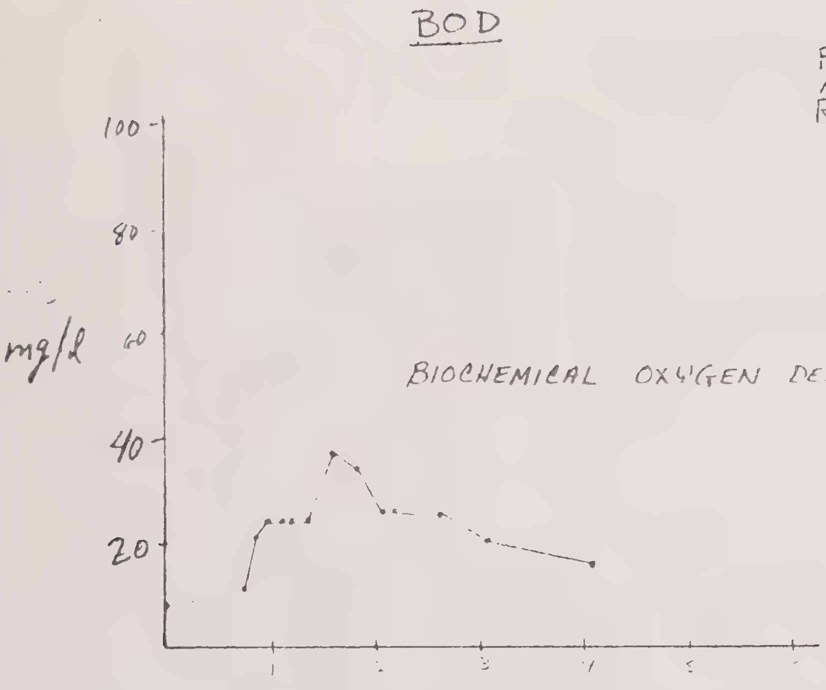


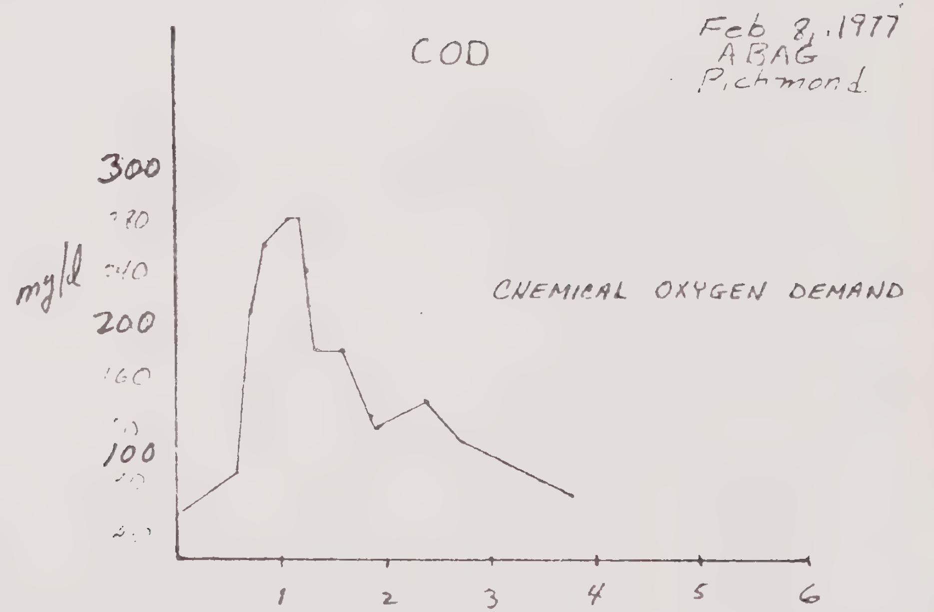


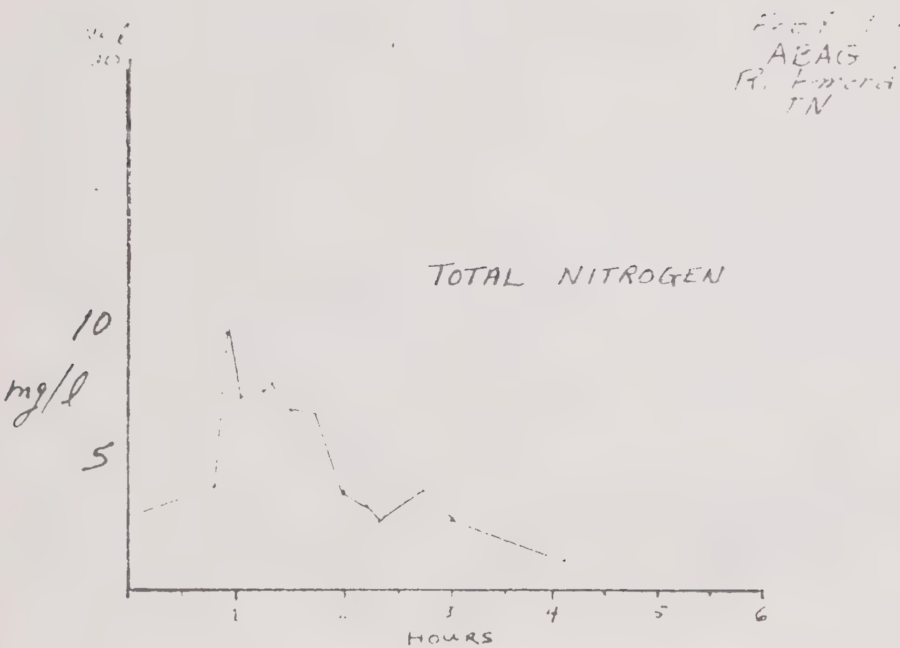


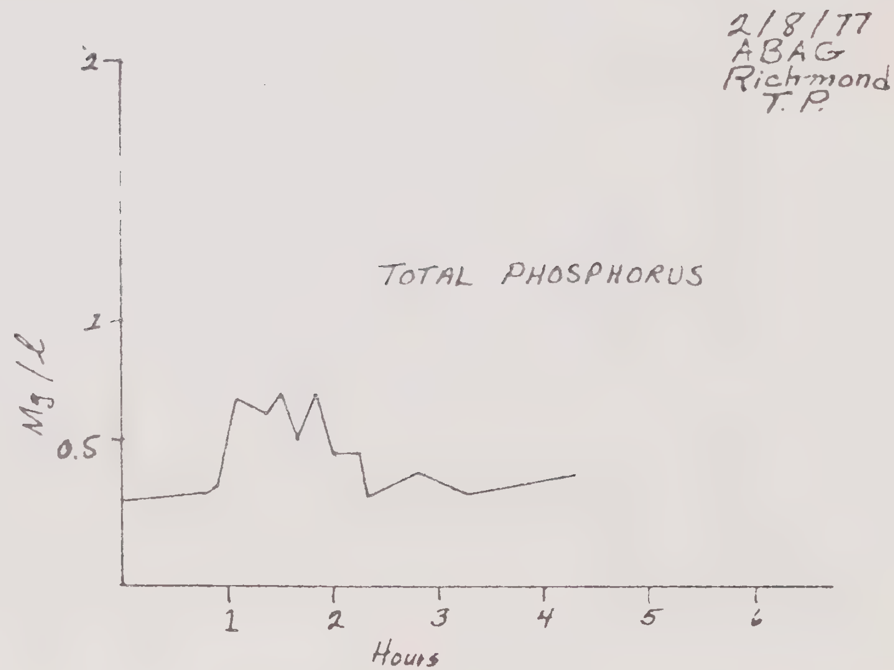
B-48

FEBRUARY 8, 1977







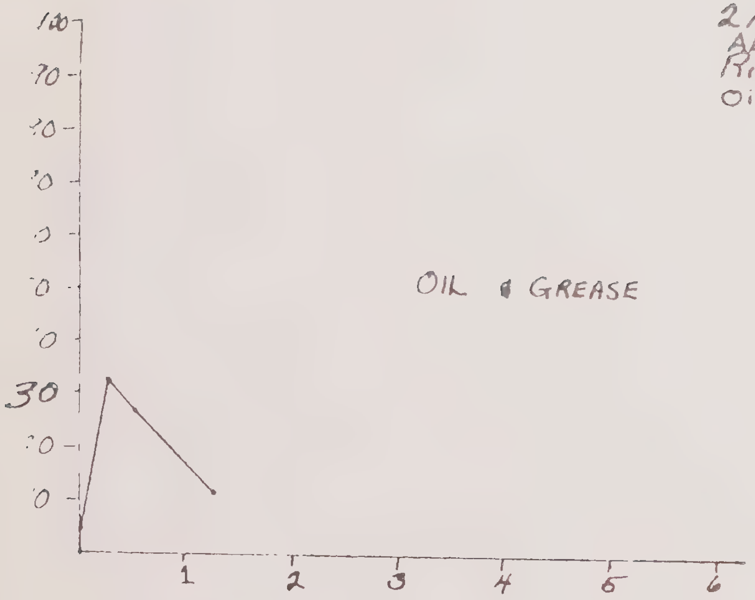


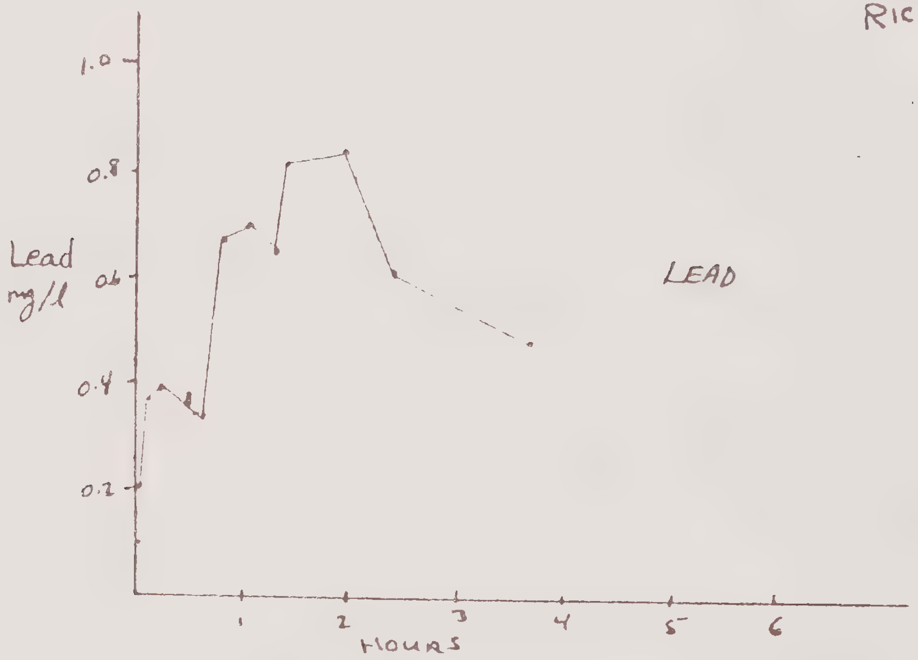
B-44

FEBRUARY 8, 1977

Feb 8.
ABAG
RICHMOND

2/8/77
ABAG
Richmond
Oil + Grease





CARD #1

WATER QUALITY DATA REPORTING FORM

1. ABAG
2. MONITORING STATION 0 1
3. STORM NUMBER 0 4
4. DATE OF SAMPLES 0 2 0 8 7 7

5. DAYS SINCE LAST RAINFALL ________
6. RAINFALL FROM PREVIOUS STORM ________ INCHES
7. TIME AT START OF RUNOFF ________

CARD	SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	SS	V.S.S.	T.D.S	LEAD
UNITS →				INCHES	CFS	°C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	0001		1031	.	0.95	13.0	7.8	11.0	8.4	55	4.08	2.50	0.32	120	2.5	280	0.70
	2		1115	0.02	1.3	12.0	7.5	10.5	12.0	85	1.5	2.45	.36	22	8	150	0.20
	3		1122	.	1.5	13.0	7.1	8.9	21	210	7.4	2.26	.38	110	30	270	.35
	4		1130	.	1.2	13.0	7.1	8.4	24	250	5.3	2.01	.70	110	38	300	.39
	5		1145	.	1.3	13.0	7.3	8.2	24	280	5.1	2.35	.66	120	52	300	.36
	6		1150	.	4.9	.	7.3	8.4	24	280	4.9	2.66	.71	180	60	250	.34
	7		1155	.	6.9	.	7.2	8.4	24	240	4.2	2.59	.56	160	54	240	.34
	8		1205	0.07	19.4	.	7.3	8.2	37	180	4.6	2.0	.72	160	51	280	.67
	9		1220	.	19.4	.	7.5	8.9	34	180	2.4	1.28	.50	180	54	200	.70
	10		1235	.	24.8	.	7.0	8.4	26	130	2.0	1.01	.50	140	41	160	.65
	11		1239	.	35.0	.	6.9	8.6	27	120	0.96	1.11	.34	160	43	160	.82
	12		1310	0.02	19.4	13.5	6.8	8.5	25	150	2.6	1.05	.43	140	46	140	.84
	13		1335	.	10.9	13.5	6.8	8.2	20	110	1.7	1.07	.37	110	31	170	.61
	14		1440	.	6.9	14.0	6.8	7.4	16	70	0.32	0.79	.41	77	23	140	.48
			1600	0.01		.	.										

CARD #2

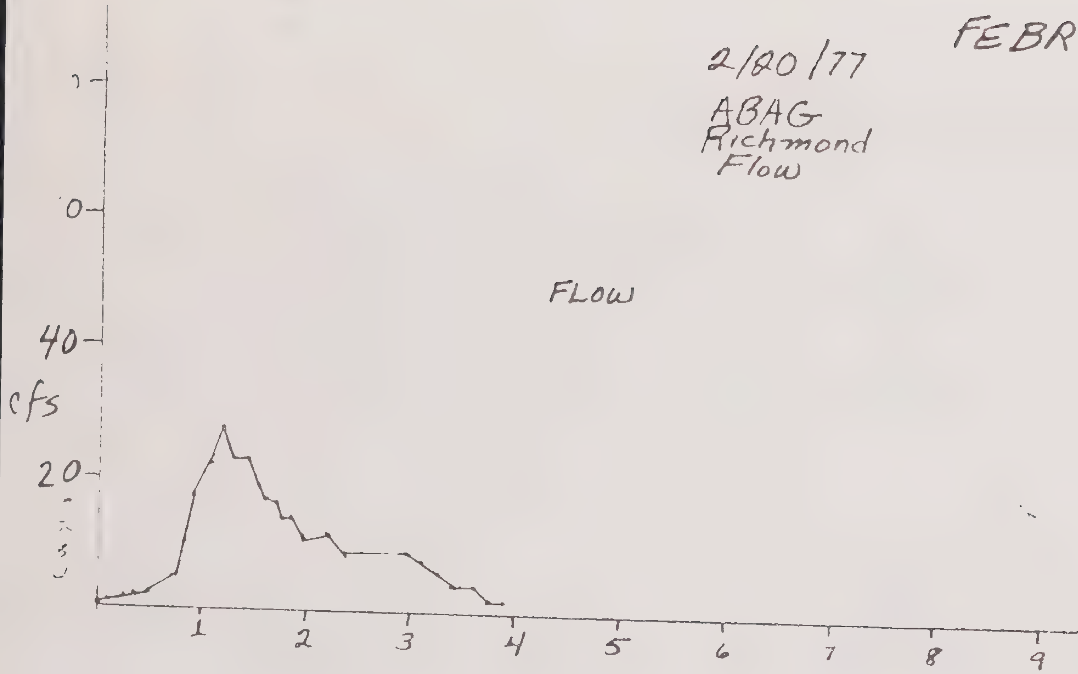
WATER QUALITY DATA REPORTING FORM

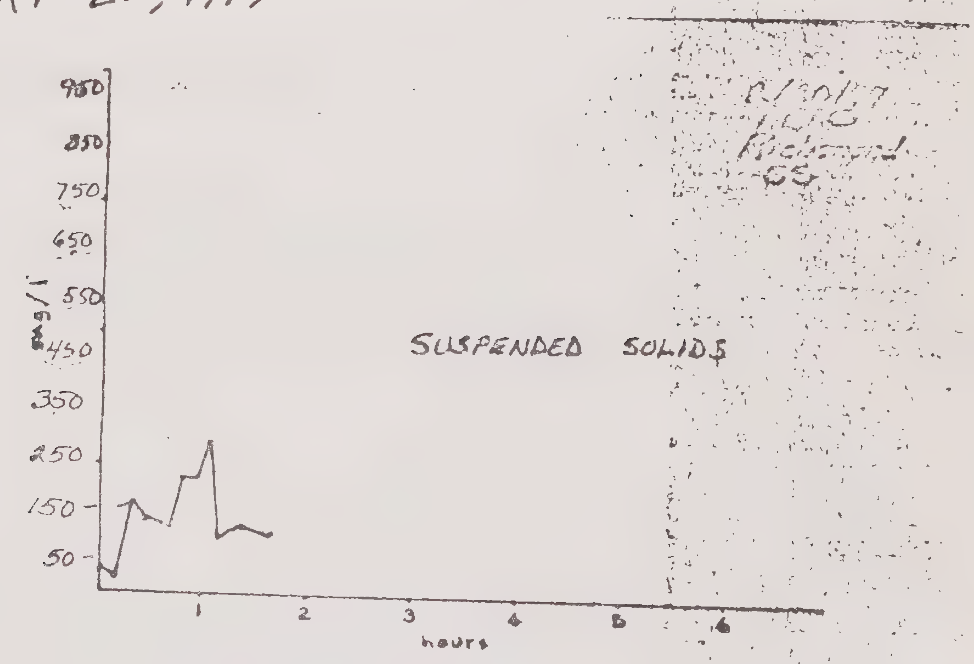
1. COUNTY ABAG
2. MONITORING STATION
3. STORM NUMBER
4. DATE OF SAMPLES 0 2 0 8 7 7

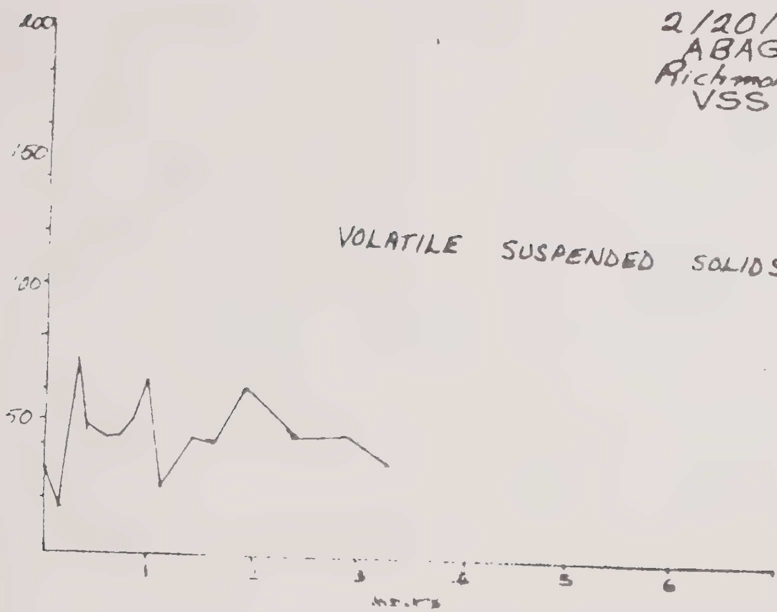
5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ___ INCHES
7. TIME AT START OF RUNOFF ______

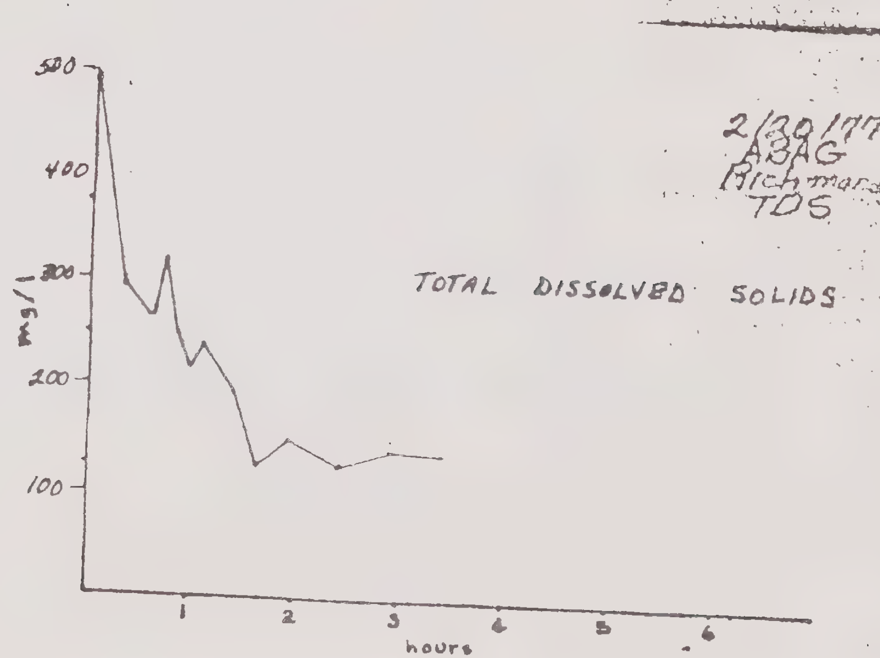
CARD	SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →			MPN/100 ml	MPN/100 ml	MPN/100 ml	~~ug/l~~ mg/l	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	ug/l	umhos	mg/l	mg/l
	0001		. E	. E	. E	.005		<1	.01		0.02	0.[illegible]				
	2		. E	. E	. E						.02	.[illegible]			4.9	
	3		. E	. E	. E						.03	.95			[illegible]	
	4		. E	. E	. E						.06	.92			33.0	
	5		. E	. E	. E						.05	1.0			27.0	
	6		. E	. E	. E						.06	.97				
	7		. E	. E	. E						.05	.88				
	8		. E	. E	. E						.06	.89				
	9		. E	. E	. E						.06	.56				
	10		. E	. E	. E						.06	.95			12.0	
	11		. E	. E	. E			2			.05	.56				
	12		. E	. E	. E						.06	.46				
	13		. E	. E	. E						.05	.40				
	14		. E	. E	. E						.04	.27				
			. E	. E	. E											

FEBRUARY 20, 1977

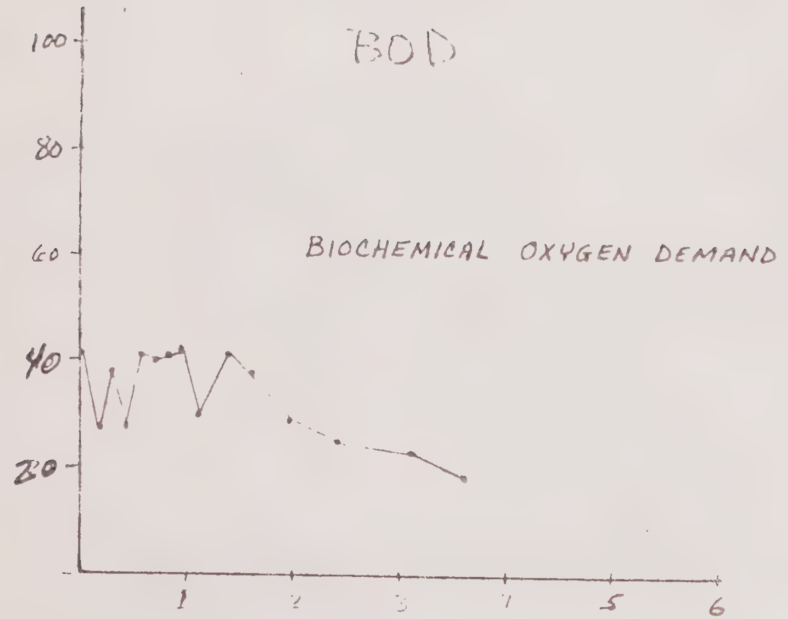


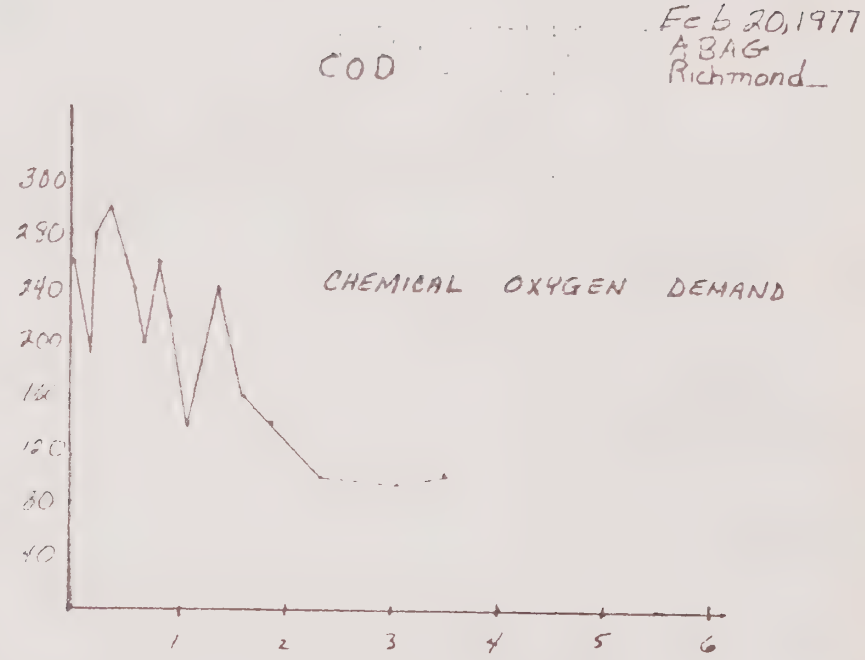


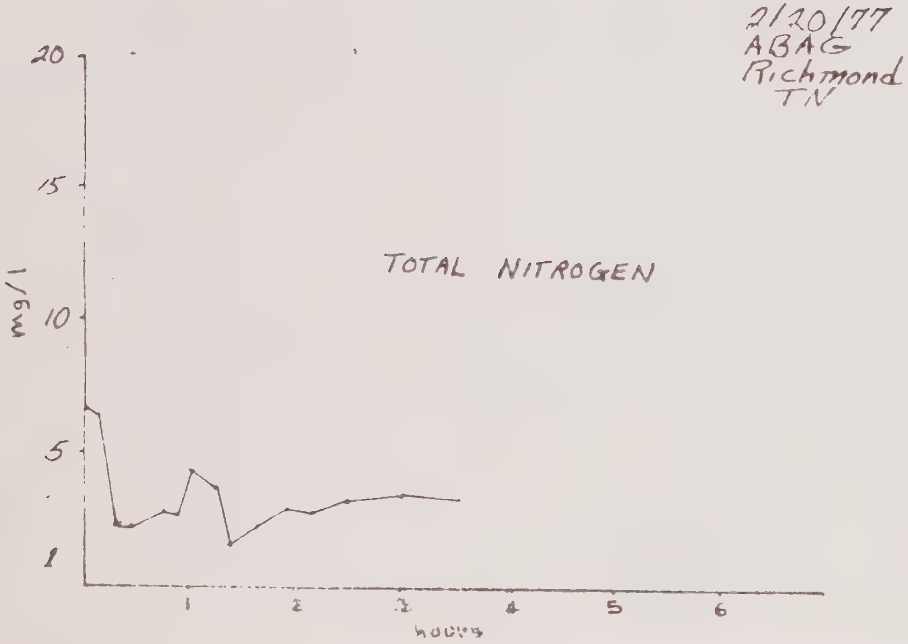


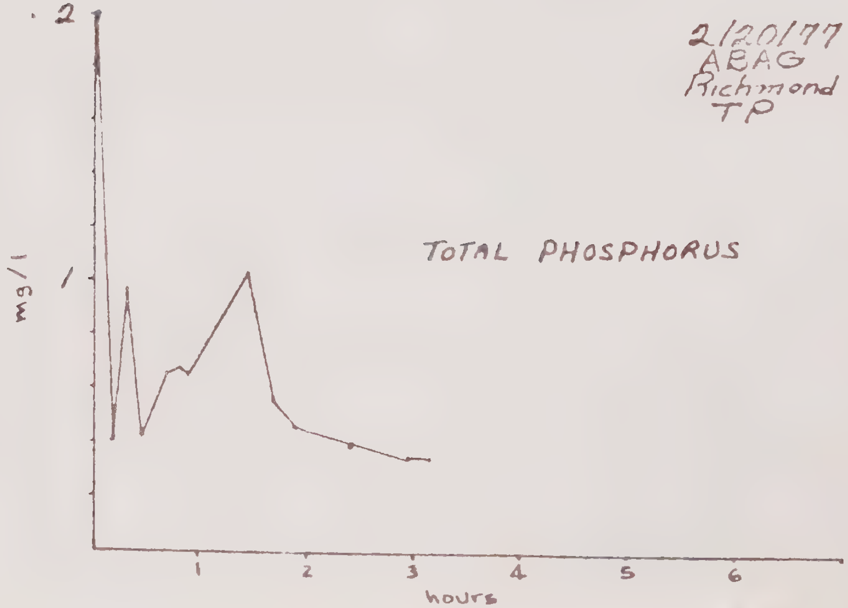


FERUARY 20, 1977









CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY ABAG
2. MONITORING STATION Richmond 0 1
3. STORM NUMBER
4. DATE OF SAMPLES 0 2 2 0 7 7

5. DAYS SINCE LAST RAINFALL ____
6. RAINFALL FROM PREVIOUS STORM ____ INCHES
7. TIME AT START OF RUNOFF 12:58

	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	NO_2 + NO_3	TOTAL P	S.S	V.S.S.	T.D.S	LEAD
UNITS →				INCHES	CFS	°F °C	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			1335	.	.02	.	.										
	A-01		1347	.	.89	14.	8.8	14.2	41	260	.3	6.41	2.0	18	31	490	.11
	A-02		1358	.	1.9	14.	8.4	11.4	27	190	.4	6.08	.42	33	18		.09
	A-03		1404	.	2.1	14.	7.8	10.3	38	280	1.2	1.4	.96	160	72		.[illegible]
	A-04		1411	.	3.5	14.5	7.7	9.4	27	290	.3	1.90	.42	140	48	290	.32
	A-05		1425	.	5.0	14.5	7.9	9.1	41	240	.3	2.41	.65	130	44	270	.21
	A-06		1431	.	10.1	15.	7.7	8.7	40	200	.3	2.41	.67	210	44	340	.27
	A-07		1433	.	17.0	14.8	7.6	8.7	41	260	1.2	3.01	.66	210	50	250	.09
	A-08		1441	.	23.8	14.8	7.5	9.2	42	220	2.8	1.11	.78	280	65	220	1.1
		?	1448	.	27.1	.	.										
	A-09		1451	.	23.8	14.8	7.3	7.1	30	140	1.0	.67	.84	100	26	240	.50
		?	1500	.	23.8	.	.										
			1507	.	18.1	.	.										
	A-10		1511	.	16.9	14.5	7.2	8.0	42	240	<0.3	1.06	1.1	130	44	190	.59
			1519	.	16.3	.	.										

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY ABAG
2. MONITORING STATION Richmond 3 1
3. STORM NUMBER
4. DATE OF SAMPLES 0 2 2 0 7 7

5. DAYS SINCE LAST RAINFALL
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF

SAMPLE NUMBER	COMPOSITE	TIME	CUMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	NO_2 + NO_3	TOTAL P	S.S	V.S.S	T.D.S	LEAD
UNITS →			INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		1524		14.1												
A-11		1526		14.1	14.5	7.1	8.0	38	160	.3	2.41	.51	110	42	140	.47
		1533		11.1												
		1547		11.5												
A-12		1547		11.5	14.5	7.2	8.1	29	140	1.2	2.41	.46	62	62	150	.32
		1556		9.7												
		1604		9.7												
		1613		9.7												
A-13		1617		9.7	14.5	7.2	7.8	25	100	<0.3	2.71	.40	45	45	120	.27
		1635		9.7												
		1645		8.0												
A-14		1657		6.1	14.2		8.0	23	95	<0.3	3.01	.36	46	46	130	.25
		1708		4.8												
		1710		4.8												
		1715		4.0												
A-15		1725		2.8	14.0		7.8	19	110	1.2	2.81	.36	35	35	130	.21
		1727		2.8												

CARD #2

WATER QUALITY DATA REPORTING FORM

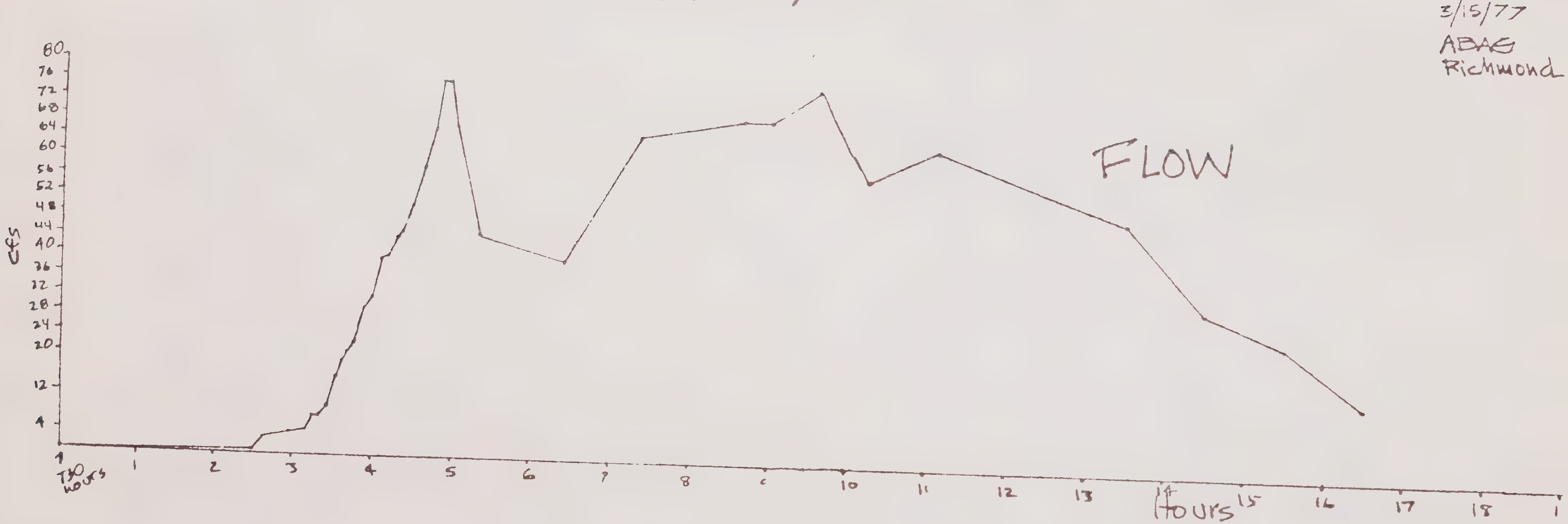
1. COUNTY ABAG
2. MONITORING STATION Richmond
3. STORM NUMBER
4. DATE OF SAMPLES 0 2 2 0 7 7

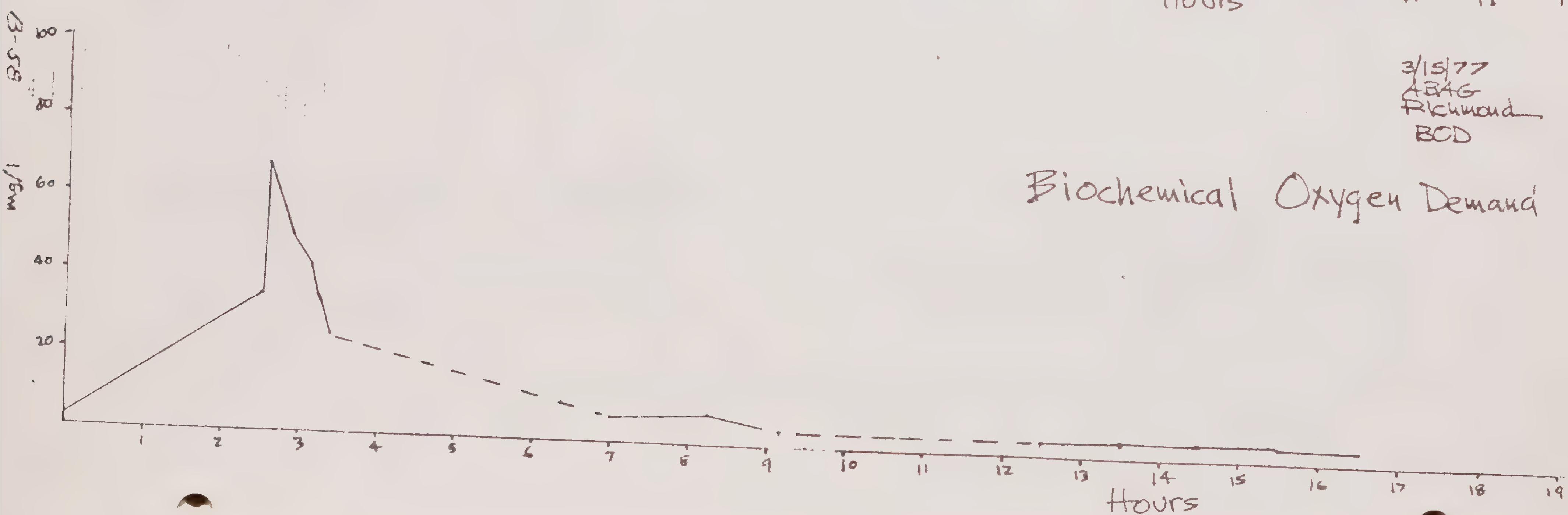
5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ___ INCHES
7. TIME AT START OF RUNOFF ______

SAMPLE NUMBER	COMPOSITE	TOTAL COLIFORMS	FECAL COLIFORMS	FECAL STREP	CADMIUM	CHROMIUM	MERCURY	SILVER	ARSENIC	COPPER	ZINC	TICH	CONDUCTIVITY	OIL & GREASE	MBAS
UNITS →		MPN/100 ml	MPN/100 ml	MPN/100 ml	mg/l	mg/l	PPb	mg/l	mg/l	mg/l	mg/l	mg/l	umhos	mg/l	mg/l
A-01		• E	• E	• E	<0.002		1.5	<0.005		.045	1.5				
A-02		• E	• E	• E	<0.002		<1	—		.052	0.64				
A-03		• E	• E	• E	<0.002		<1	—		.062	1.0				
A-04		• E	• E	• E	<0.002		<1	—		.13	1.0				
A-05		• E	• E	• E	<0.002		<1	—		.046	.69				
A-06		• E	• E	• E	<0.002		<1	—		.047	.72				
A-07		• E	• E	• E	<0.002		<1	—		.064	.91				
A-08		• E	• E	• E	<0.002		1.3	—		.064	.74			3.8	
A-09		• E	• E	• E	<0.002		<1	—		.034	.44				
A-10		• E	• E	• E	<0.002		<1	—		.046	.61				
A-11		• E	• E	• E	<0.002		<1	—		.042	.47			5.7	
A-12		• E	• E	• E	<0.002		<1	—		.034	.38				
A-13		• E	• E	• E	<0.002		1.4	—		.034	.37				
A-14		• E	• E	• E	<0.002		<1	—		.034	.33				
A-15		• E	• E	• E	<0.002		<1	—		.032	.28				

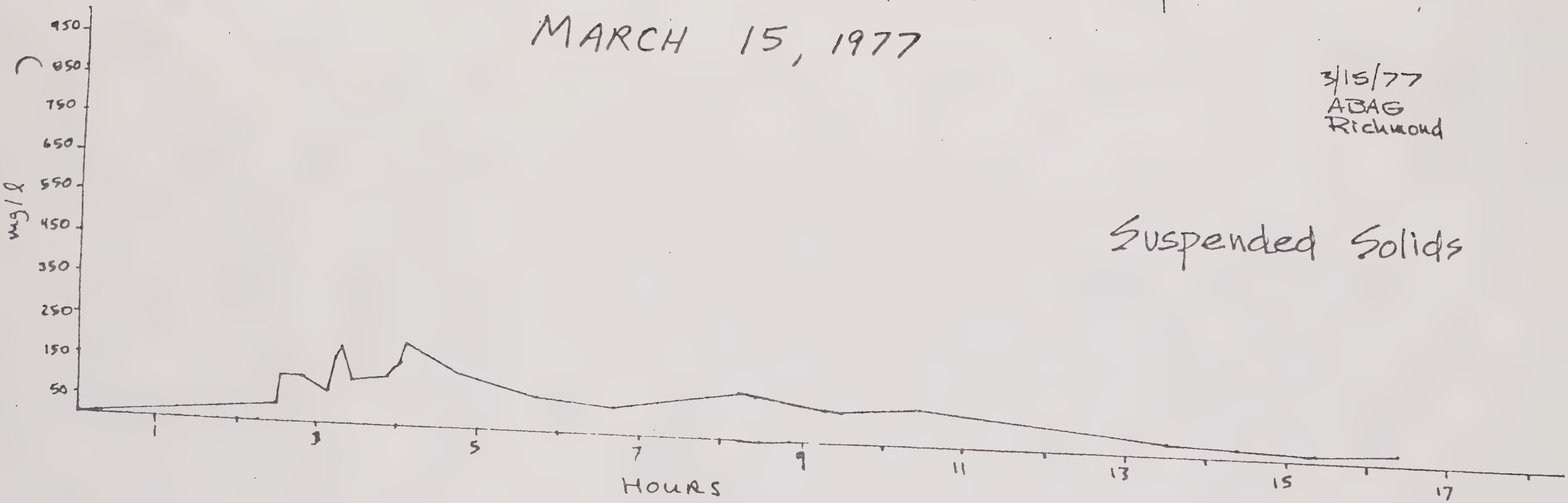
B.57

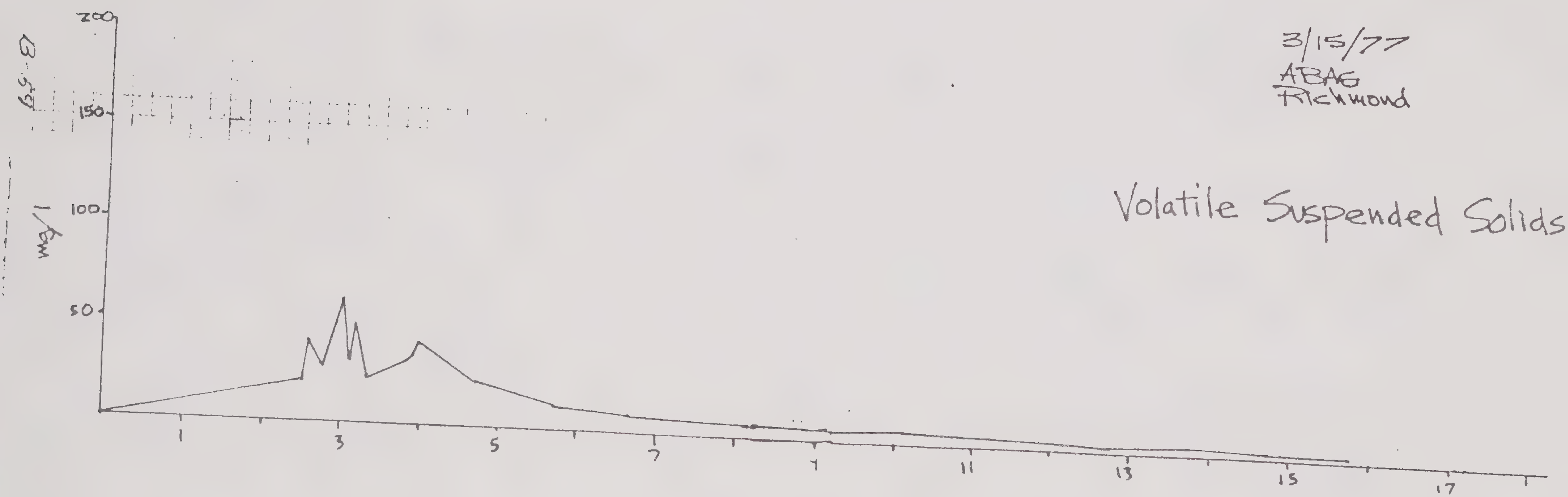
MARCH 15, 1977



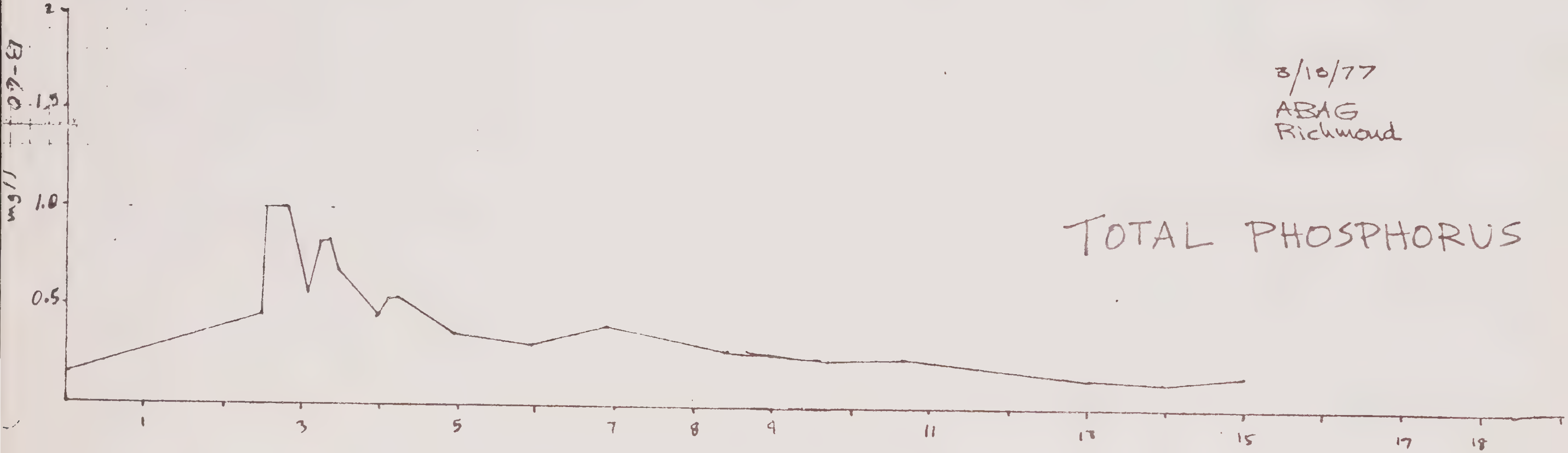


MARCH 15, 1977





MARCH 15, 1977



CARD #1

WATER QUALITY DATA REPORTING FORM

1. ABAG
2. MONITORING STATION Richmond 0 1
3. STORM NUMBER
4. DATE OF SAMPLES 0 3 1 5 7 7
5. DAYS SINCE LAST RAINFALL
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF 0919

	SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	$NO_2 + NO_3$	TOTAL P	S.S	V.S.S	T.D.S	LEAD
UNITS →				INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Dry Weather Sample →	2001		0730		.50				3.0	<10	2.4	.532	.15	<1	<21	430	
	2002		1004		1.2		8.4		35	65	4.3	4.44	.45	48	20	340	
	2003		1006		2.9		7.3		68	290	9.5	1.91	1.0	110	39	250	
	2004		1026		4.2		7.3		50	196	6.7	1.61	1.0	110	28	180	
			1034		4.5												
			1038		7.9												
	2005		1041		7.9		7.5		26	111	0.9	2.11	.57	78	61	210	
			1044		10.5												
	2006		1049		17.2		7.0		42	180	7.2	1.71	.83	160	31	170	
			1051		18.0												
	2007		1055		22.9		7.1		34	196	11.0	1.61	.84	180	49	100	
	2008		1104		29.8				25	142	15.0	1.21	.68	110	23	180	
			1105		33.												
			1110		38.0												
			1115		40.5												

WATER QUALITY DATA REPORTING FORM

CARD #1

1. COUNTY ABAG
2. MONITORING STATION Richmond [0][1]
3. STORM NUMBER [ ][ ]
4. DATE OF SAMPLES [0][3][1][5][7][7]

5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF ______

SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	NO_2 + NO_3	TOTAL P	S.S.	V.S.S.	T.D.S.	LEAD
UNITS →			INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		1122		45.2												
		1124		46.0												
2009		1133		51.0												
2010		1140		58.1					141	1.1	.80	.47	140	31	66	
		1146		66.0					96	1.6	.84	.63	150	37	72	
2011		1151		76.5					146	1.3	.56	.52	190	42	60	
		1159		76.5												
		1205		66.0												
2012		1225		45.2												
2013		1325		40.5					88	1.0	.42	.38	130	23	45	
2014		1420		66.0					58	1.6	.54	.30	80	13	67	
		1535		70.0					88	1.1	.021	.40	69	9.2	44	
2015		1555		70.0												
		1630		76.5				6.0	17	1.8	.44	.28	110	8.5	47	
2016		1710		58.1				7.2	34	.48	.47	.25	71	56	73	

B-62

CARD #1

WATER QUALITY DATA REPORTING FORM

1. COUNTY ABAG
2. MONITORING STATION Richmond 0 1
3. STORM NUMBER
4. DATE OF SAMPLES 0 3 1 5 7 7
5. DAYS SINCE LAST RAINFALL ______
6. RAINFALL FROM PREVIOUS STORM ______ INCHES
7. TIME AT START OF RUNOFF ______

SAMPLE NUMBER	COMPOSITE	TIME	CUMMULATIVE RAINFALL	FLOW	TEMP	pH	DO	BOD_5	COD	K-N	NO_2 + NO_3	TOTAL P	S.S.	V.S.S.	T.D.S	LEAD
UNITS →			INCHES	CFS	°F	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2017		1800	.	64.9	.	.		4.8	42	.16	.65	.26	82	68	78	
		2055	.	51.0	.	.									87	
2018		2110	.	51.0	.	.		3.6	34	2.3	.868	.16	35	7	87	
2019		2202	.	33.1	.	.		3.9	34	2.9	.914	.15	28	11	74	
2020		2307	.	27.2	.	.		4.2	97	2.6	.926	.14	19	8	75	
2021		0007	.	15.6	.	.		4.2	34	2.2	1.25	.18	26	8	110	

CONTRA COSTA COUNTY

SURFACE RUNOFF MANAGEMENT PLAN

APPENDIX C

MODELING

October 1977

CONTENTS

TABLES

FIGURE

MACROSCOPIC PLANNING MODEL (MAC)

The MAC model is generally described in Section IV-C of the Plan and in more detail in Appendix A. The purpose of this dissertation is to detail the calibration efforts and to identify characteristics inherent in the existing program, the knowledge of which is necessary for the proper evaluation of the model's output.

Derivation of "K" Factor

By definition the "K" factor is a measure of the amount of precipitation which appears directly as surface runoff.

The determination of the portion of streamflow which can be categorized as surface runoff can be estimated by examining streamflow records and deducting therefrom the base flows which occur prior to and subsequent to identified precipitation events. These base flows are a combination of natural occurring flows and subsurface drainage. For the purposes of this study such base flows were assumed to be free of pollutants. Table C-1 lists the available streamflow records for the period 1968 to 1975 and the estimated base flows for six streams.

Precipitation records were examined and stations selected deemed to be representative for the drainage areas of each stream gage. The total annual precipitation in both inches and acre feet for each stream gage drainage area is also listed in Table C-1.

The annual "K" factors were then calculated and plotted on Figure C-1 as were the average "K" values determined after eliminating the very low precipitation year of 1972. Examination of Figure C-1 clearly demonstrates the wide variability in "K" factors from year to year and the inherent dangers of utilizing the MAC model to predict a specific annual event. Figure C-1 also suggests the possibility of slightly refining the MAC model by incorporating a variable "K" factor as a function of total annual rainfall.

A cursory examination of "K" factors derived on a monthly rather than annual basis was made and as would be anticipated the variability was substantially greater.

The variability in "K" factors appears to be directly related to the amount of open space within a drainage area as against the developed or paved areas. Other contributing factors appear to be type of terrain (e.g. rugged, hilly, gently sloping) and permeability of soil.

TABLE C-1

Base Data - "K" Factor Derivation

Year	Gross RO A.F.	Base Fl A.F.	SWRO A.F.	Precip. inches	A.F.	"K"	
Marsh Creek - 27264 Acres							
1969	14180	4509	9671	18.12	41169	.24	
1970	8900	5352	3548	13.50	30672	.12	
1971	4750	2969	1781	11.89	27014	.07	
1972	164	86	78	5.85	13291	.01	
1973	13930	6061	7869	21.44	48712	.16	
1974	7150	3395	3755	13.37	30377	.12	
1975	3880	1808	2072	11.10	25219	.08	Avg. = 0.13
Walnut Creek @ Concord - 54,464 Acres							
1969	45370	9314	36056	28.71	130305	0.28	
1970	40900	9663	31237	22.48	102029	0.31	
1971	26750	9275	17475	20.92	94949	0.18	
1972	7790	4524	3266	10.07	45704	0.07	
1973	51790	15321	36469	27.13	123134	0.30	
1974	42680	17121	25559	24.47	111061	0.23	
1975	28700	11998	16702	19.43	88186	0.19	Avg. = 0.25
Arroyo del Hambre - 9664 Acres							
1968	1140	426	714	12.52	10083	.07	
1969	5830	2332	3498	21.99	17709	.20	
1970	3940	897	3043	19.85	15986	.19	
1971	2490	1344	1146	17.06	13739	.08	
1972	286	114	172	8.59	6918	.02	
1973	6250	2548	3702	24.05	19368	.19	
1974	4140	1863	2277	22.56	18168	.13	
1975	2190	816	1374	18.75	15100	.09	Avg. = 0.14
Pinole Creek - 6,400 Acres							
1968	1570	477	1093	19.51	10405	.11	
1969	6450	2112	4338	28.84	15381	.28	
1970	5210	1525	3685	25.66	13685	.27	
1971	2410	1090	1320	18.43	9829	.13	
1972	199	153	46	10.19	5435	.01	
1973	5950	1578	4372	33.54	17888	.24	
1974	5520	1922	3598	29.28	15616	.23	
1975	1740	650	1090	20.70	11040	.10	Avg. = [illegible].19

TABLE C-1

Base Data - "K" Factor Derivation

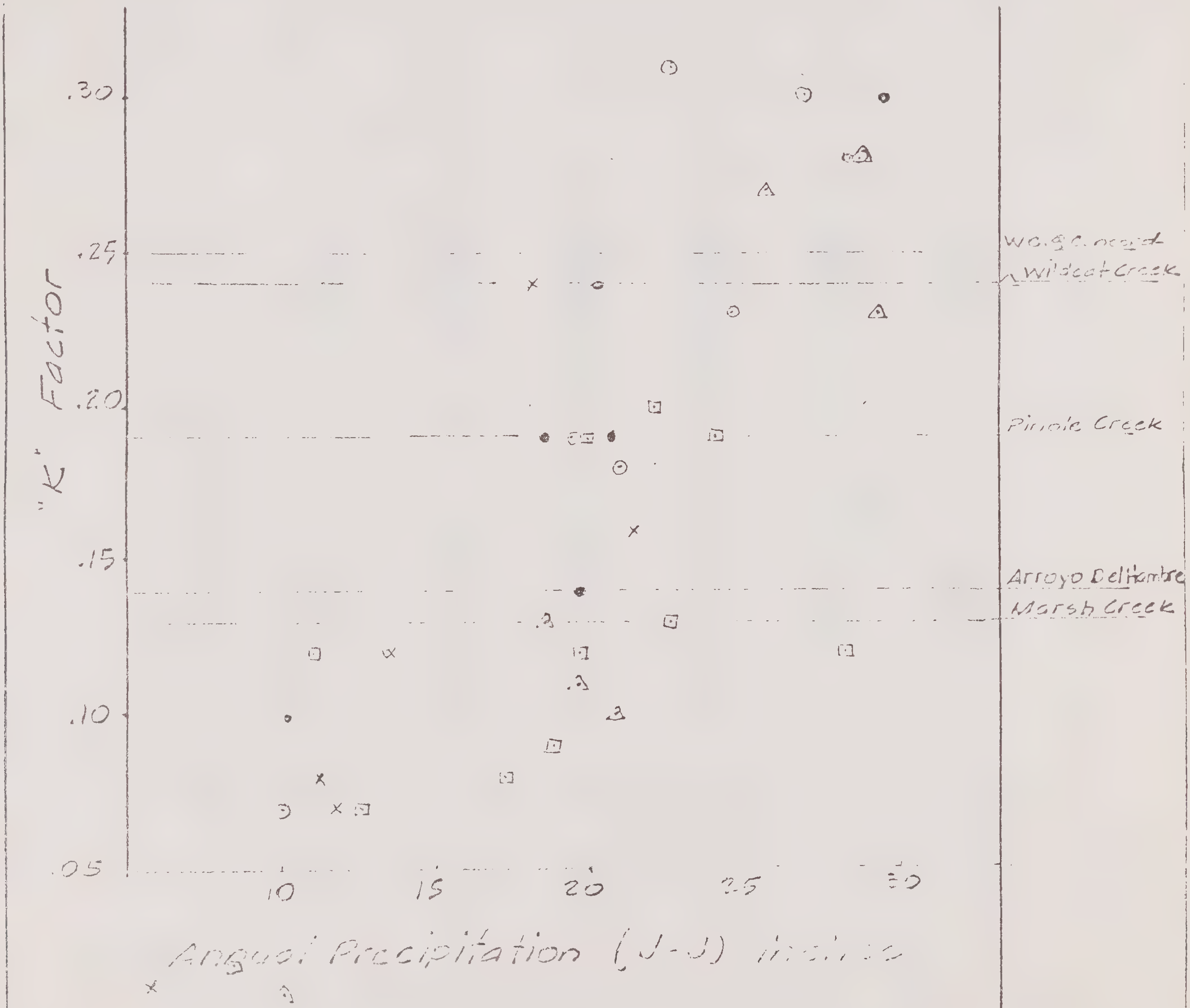
Year	Gross RO A.F.	Base Fl A.F.	SWRO A.F.	Precip. inches	A.F.	"K"	
Wildcat Creek - 5562 Acres							
1968	1600	355	1245	19.51	9043	.14	
1969	5660	1974	3686	28.84	13367	.28	
1970	5420	659	4761	25.66	11893	.40	
1971	2640	1006	1634	18.43	8542	.19	
1972	630	150	480	10.19	4723	.10	
1973	7230	1982	5248	33.54	15546	.34	
1974	6300	2272	4028	29.28	13571	.30	
1975	2840	994	1846	20.59	9543	.19	Avg. = 0.26
Rheem Creek - 698 Acres							
1968	685	107	578	19.51	1135	.51	
1969	1420	594	826	28.84	1677	.49	
1970	1340	371	969	25.66	1493	.65	
1971	801	134	667	24.1	1402	.48	
1972	456	76	380	10.19	593	.64	
1973	1780	256	1524	33.54	1951	.78	
1974	1350	273	1077	29.28	1703	.63	
1975	875	113	762	20.74	1206	.63	Avg. = 0.60

Note: Average values exclude 1972 values except for Rheem Creek

CONTRA COSTA COUNTY PUBLIC WORKS DEPARTMENT
COMPUTATION SHEET

Figure C-1

PROJECT NAME ABAG 208 SHEET ___ OF ___
PROJECT NO. ___ CALC. BY Q.T.S. DATE April 1977
SUBJECT K-Factor CHKD. BY H.M. DATE June, 1977



	Ave. K
⊙ Walnut Creek & Concord	0.25
△ Pinole Creek	0.19
⊡ [illegible]	[illegible]
• Wildcat Creek	0.2[illegible]
× Marsh Creek	0.13

Control Measures Testing

The MAC model's principle functions are limited to the provision of reasonable estimates of present average annual pollutant loadings, and to the prediction of changes in these loadings as a result of future development and/or the implementation of a wide variety of control measures.

As the MAC model is presently formulated complete new computer runs must be made for each control measure to be tested. For instance, if a computer run is made for present conditions which may include street sweeping in commercial areas on a twice monthly schedule and a comparison is required to determine the effectiveness of sweeping the commercial area on a twice weekly schedule an appropriate modification to the C factors for commercial land use must be made and a complete new computer run made.

A substantial degree of flexibility, and usefulness, could be attained if the MAC model were revised to totalize pollutant loadings not only by watershed but also by land use categories within that watershed.

The second major factor effecting the evaluation of MAC model output is the paucity of reliable data upon which modifications to "K" and/or "C" factors can be based for each of the control measures to be tested. For example, what "C" factor modification would be appropriate if a substantial portion of a commercial area was to be closed to automobile traffic? Or what modification of a "K" factor would properly represent the erosion control measure of reseeding exposed slopes?

Should further use of the MAC model be seriously considered it is recommended that the foregoing issues be examined in greater detail and appropriate measures be taken to insure that the model's output will be reliable and useful.

STORM WATER MANAGEMENT MODEL (SWMM)

The demonstration watershed selected for analysis with SWMM was the Pine-Galindo Creek watershed consisting of approximately 18,000 acres. This watershed contains substantial areas of permanent open space as well as significant areas of developable lands, residential, commercial and industrial developments. The terrain varies from rugged to gently sloping. One of the principle reasons for selecting Pine-Galindo watershed for SWMM modeling was the typical nature of the watershed hence it was felt that any findings developed from the modeling exercise would be applicable to other significant areas of the county.

The delineation of the physical characteristics of the Pine-Galindo watershed necessary for input to SWMM was facilitated by use of the following documents:

1. 1"=300' aerial photographs of the entire area.

2. 1"=1000' enlargements of USGS 7-1/2' quad sheets.

3. 1"=300' maps of existing storm drains (furnished by the city of Concord).

4. 1973 Contra Costa County Soils Survey prepared by Soils Conservation Service.

These documents were supplemented by appropriate field observations.

In consultation with representatives of Resources Management Associates (RMA) consultants to ABAG on SWMM, 59 subcatchments were delineated and their hydraulic characteristics estimated. In order to stay within the functional limitations of SWMM it was necessary to substitute certain theoretical hydraulic relationships for the actual data to accomplish the following:

1. Substitution of a single storm drain for one or more networks within a subcatchment.

2. Enlargement of pipe diameters to prevent:

   a. Pressure flow (SWMM cannot handle).

   b. Overflow (SWMM "looses" all overflows).

3. Enlargement of natural channels to prevent overflow.

In addition to the foregoing data water quality samples were collected and analyzed (Reference Appendix E) and streamflow measurements were taken at the Market Street gage site. Unfortunately insufficient runoff occurred over a wide enough flow range to develop even a preliminary depth vs flow curve at this location.

All of the above data was supplied to RMA for review and initial SWMM calibration. Lacking [illegible] flow data RMA elected to calibrate the

Pine-Galindo watershed utilizing data developed from similar demonstration watersheds within the Bay Area. Upon verbal communication from RMA that the SWMM was calibrated for the Pine-Galindo watershed several computer runs were made to examine the effect of antecedent dry days upon pollutant loadings and the effects of varying the frequency of street sweeping and the number of passes with the following results:

Antecedent Dry Days	St. Sweep Freq.	BOD (lbs)	SS (lbs)	N (lbs)	P (lbs)
5	30	884	92500	481	56
10	30	1740	102000	940	104
15	30	2600	112000	1400	152
18	30	3120	118000	1680	181
22	30	3810	126000	2040	219
25	30	4320	131000	2320	248
35	30	7240	164000	3880	411
22	7	1620	101000	876	98
22	14	3150	118000	1690	183
22	21	5080	140000	2720	290
22	14/2	2620	112000	1410	153
22	30/2	3810	126000	2040	219

Our examination of these results raised some serious questions as to the reliability of SWMM as a predictive and/or analytical tool. For example, examination of pollutant loadings with varying periods of antecedent days and with a constant frequency of street sweeping indicates a linear build-up of pollutants for at least 35 days. This is inconsistent with the theory that following a runoff event pollutants accumulate rapidly for a week or so then taper off to a constant level. More study is required to determine which theory is correct. It is interesting, but somewhat disturbing, to note that street sweeping on a 30 day frequency evidently has no water quality benefits. A similar observation can be made for making 2 street sweeping passes every thirty days.

Some of the rather fixed input relationships for SWMM are shown on Table C-2 and Table C-3.

These and other observations which can be made from the data presented serve to point out the importance and necessity of further investigations and refinement of analytical procedures prior to their use within the decision making process.

Table C-2 DUST AND DIRT ACCUMULATION

Type	Urban Land Use	Pounds DD/dry day/100 ft-curb
1.	Single family residential	0.7
2.	Multi-family residential	2.3
3.	Commercial	3.3
4.	Industrial	4.6
5.	Undeveloped or park	1.5

[1]Based on 1969 APWA report for Chicago (1)

Table C-3 MG POLLUTANT PER GRAM OF DUST AND DIRT[1] FOR EACH URBAN LAND USE TYPE

Parameter	Urban Land Use Type (Table 1-1)				
	1	2	3	4	5[2]
SS	1000.0	1000.0	1000.0	1000.0	1000.0
BOD	5.0	3.6	7.7	3.0	5.0
COD	40.0	40.0	39.0	40.0	20.0
Coliforms[3]	1.3×10^6	2.7×10^6	1.7×10^6	1.0×10^6	0.0
Settleable Solids	100.0	100.0	100.0	100.0	100.0
N	0.48	0.61	0.41	0.43	0.05
PO_4	0.05	0.05	0.07	0.03	0.01
Grease[4]	1.00	1.00	1.00	1.00	1.00

1. Most values are based on 1969 APWA report (1).
2. Values for undeveloped and park lands are assumed.
3. Units for coliforms are MPN/gram.
4. All values are assumed.

FINAL
DRAFT

MARIN COUNTY SURFACE RUNOFF MANAGEMENT PLAN

COUNTY OF MARIN
Comprehensive Planning Department
Department of Public Works
January, 1978

TABLE OF CONTENTS

SUMMARY

I. SUMMARY

The Marin County Surface Runoff Management Plan was prepared by Marin County under contract to the Association of Bay Area Governments as the County's contribution to the Environmental Management Plan for the San Francisco Bay Region (EMP). This Environmental Management Plan is the area-wide plan required by the Federal Water Pollution Control Act of 1972. Although this legislation requires planning and implementation measures for water quality problems, the Environmental Management Plan includes a broad range of environmental issues including air quality and solid waste. The Surface Runoff Management Plan portion of this area-wide plan specifically addresses potential water quality problems resulting from surface runoff (non-point) in urban and rural settings and assesses possible control measures and their impacts.

Several techniques were employed to determine the nature of surface runoff water quality in Marin County and the effect of watershed systems on receiving bodies of water. A storm water sampling program related to land use types was implemented; but with limited results due to the continuing drought. In addition, the data base was supplemented with field investigation, assembly of past data, personal interviews, computer modelings and a review of lost or impaired beneficial uses of any bodies of water in Marin County due to pollution.

Because of the drought and the general lack of attention paid to surface runoff pollution in Marin County in the past, the data obtained by the above methods was quite sparse. Accordingly, the conclusions reached in this report must be considered as preliminary and very tentative, and the recommendations contained herein were made with this in mind.

Conclusions

1. There are no identifiable serious* pollution problems in Marin County resulting from surface runoff.
2. There are four minor specific problems in Marin County at least partially attributable to surface runoff pollution. These are:
   a. Richardson Bay occasionally experiences excessive algae growth that causes visual and odor nuisances as well as possible dissolved oxygen problems.
   b. Shellfish harvesting is prohibited in Richardson Bay due to bacterial contamination.
   c. All creeks in Marin's eastern urban corridor have excessive levels of nutrients which sometimes cause visual and odor nuisances.
   d. The reduction of the population of salmon spawning in Marin's creeks is at least partially attributable to excess nutrient levels and siltation caused by surface runoff.
3. Marin's surface runoff contains substantial quantities of suspended solids, BOD, nutrients and possibly bacteria and lead. These constituents are potentially harmful and may contribute to pollution problems in San Francisco Bay outside of Marin's borders.
4. Several of Marin's water supply reservoirs are eutrophic (See Glossary). These are Nicasio, Alpine, Lagunitas, Pheonix and Stafford Lakes.

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* Requiring immediate remedial action

Recommendations

1. A continuing water quality monitoring program should be instituted to evaluate suspected problems more closely and to maintain a surveillance for new ones.
2. In combination with this monitoring program, a three phase implementation program to address identified surface runoff problems should be established. Each phase will begin with a determination of the level of the surface runoff problem. If necessary, one or more control measures designed to meet these identified problems should be implemented. See Figure 1.
3. The first phase of the recommended implementation program should consist of those control measures which will maintain and improve the high quality of water now enjoyed in Marin County. These control measures are considered as best management practice techniques and are low or no cost, easily implementable actions. Implementation of second and third phase control measures will be pursued only if pollutant levels are shown quantifiably to be a problem. See Tables 1 & 2.

The specific near term efforts to implement these recommendations are shown in Table 3.

TIME LINE OF SURFACE RUNOFF MANAGEMENT PLAN

PHASE I	1/1/78	Preparatory work for Phase I control measures Surface runoff water quality sampling Computer model refinement
	6/30/78	Implement Phase I control measures
	9/30/78	Control measure monitoring Surface runoff water wuality sampling Computer model refinement
	6/30/79	Computer model runs with refined data
PHASE II	7/1/79	Are Phase II control measures needed? No - Continue Phase I measures Yes: Preparatory work for Phase II control measures Surface runoff water quality sampling Computer model refinement
	6/30/80	Implement Phase II control measures
	9/30/80	Control measure monitoring Surface runoff water quality sampling Computer model refinement
	6/30/81	Computer model runs with refined data
PHASE III	7/1/81	Are Phase III control measures needed? No - Continue Phase I & II measures Yes: Preparatory work for Phase III control measures Surface runoff water quality sampling Computer model refinement
	6/30/82	Implement Phase III control measures
	9/30/82	Control measure monitoring Surface runoff water quality sampling Computer model refinement
	6/30/83	Computer model runs with refined data
	7/1/83	Has the interim goal of P. L. 92-500 been met? Yes - Continue all implemented control measures No - Consider Level IV control measures

FIGURE 1

TABLE 1

SURFACE RUNOFF MANAGEMENT PLAN

RECOMMENDATIONS FOR URBAN CONTROL MEASURES PHASE ONE

CONTROL MEASURE/and Pollutants Addressed	General Description	Implementing Agency (s)	Schedule of Action	Legal Authority	Financing Mechanism	Enforcement Regulation	Other Incentives
1.) PUBLIC INFORMATION PROGRAM Virtually all pollutants addressed	Media approach to educate to reduce pollutants	CRWQCB ABAG Public Works	ABAG schedule Draft list of erosion control measures Attach list to building, grading & creek permits 9/30/78	UBC and local grading ord.	Federal, State Institutional	N. A. Inspection of sites for conformance	Public awareness & education
2.) PARKING RESTRICTIONS FOR SWEEPER EFFICIENCY Solids, B.O.D. & C.O.D.	Ran parking by street side to allow sweeper access	Local Police & Public Works Agencies	Implement Fiscal 78/79	Amend local codes	Federal and/or State grants Parking violation fund	Parking violation program by local police agency	Aesthetics of clean environment. Public Health & Sanitation
3.) CONCENTRATE SWEEPING EFFORTS IN HIGHLY CONTAMINATED AREAS Solids, B.O.D. & C.O.D.	Increase sweeping due to land use or seasonal NEEDS	Public Works	Not applicable, in	In effect	In effect	In effect	Aesthetics of clean environment. Public Sanitation
4.) REPAIR STREETS Solids	Repair chuck holes, etc., in street surface	Public Works Caltrans	Continued maintenance of existing facilities	Title 13, Title 3, 12 Marin County Code	State Gas Tax Vehicle code fines Sales Tax	Maintenance of existing facilities by Public Works	Public safety Extended road life
5.) CLEAN CATCH BASINS & STORM DRAINS Solids, B.O.D. & Decomposing Organic Matter	Remove materials collected in catch basins & storm drains	Public Works	Review & Improve by 9/30/78	Maintenance of existing facilities	General Fund Property Tax	Continued maintenance of existing facilities by Public Works	Improve drainage. Reduce flood potential
6.) ENFORCE EROSION CONTROL REQUIREMENTS IN GRADING ORDINANCES Solids	Enforce existing requirements to control erosion during and following construction or grading	Public Works	Implement by 9/30/78	Marin County Code Sec 23.04.110 23.06.050 23.08	Institutional General Fund Property Tax Development Fee	Codes as cited, enforced by Public Works	Flood prevention due to reduced siltation Air Quality Improvement thru dust control

TABLE 1 (CONTD)

SURFACE RUNOFF MANAGEMENT PLAN

RECOMMENDATIONS FOR URBAN CONTROL MEASURES PHASE ONE

CONTROL MEASURE/and Pollutants Addressed	General Description	Implementing Agency (s)	Schedule of Action	Legal Authority	Financing Mechanism	Enforcement Regulation	Other Incentives
7.) IMPROVE ROADSIDE DRAINAGE Solids	Debris removal, dredging of culverts & drain pipe installation	Public Works Caltrans	N. A.	Marin County Code Ch 3.12 Ch 13.14	State Gas Tax Vehicle Code Fines General Fund Property Tax	Continuing Public Works maintenance program	Improve drainage & reduce flood potential & roadside erosion

TABLE 2

SURFACE RUNOFF MANAGEMENT PLAN

RECOMMENDATIONS FOR URBAN CONTROL MEASURES, PHASE ONE

CONTROL MEASURE/and Pollutants Addressed	General Description	Implementing Agency (s)	Schedule of Action	Legal Authority	Financing Mechanism	Enforcement Regulation	Other Incentives
1.) PUBLIC INFORMATION PROGRAM Virtually all pollutants addressed	Media approach to educate to reduce pollutants	CRWQCB ABAG Public Works	ABAG schedule Draft list of erosion control measures Attach list to building, grading & creek permits 9/30/78	N. A. U. B. C. Local grading ord.	Federal and State Institutional	N. A. Inspection of sites for conformance	Public awareness & education
2.) PERFORMANCE STANDARDS WITHIN WATER SUPPLY WATERSHEDS All Pollutants	Criteria which must be met when development occurs within water supply watersheds to insure water quality	Public Works, Planning, Municipal Water Districts, Parks, Recreation & Open Space Districts, Farm Advisor, Bldg Inspection, Agricultural Commissioner, County Counsel, Resource Conservation District	Establish committee to develop standards 4/30/78 Develop standards & draft amendments to, or new ordinance 8/1/78 BOS adopt ordinance 9/30/78	Local ordinance to be created as needed	Institutional	Application of ordinance when proposed changes in land use are requested by Planning & Public Works	Increased water quality allowing for less intense use of expensive chemicals to meet health standards. Reduced siltation for increased reservoir life
3.) ENFORCE EROSION CONTROL MEASURES IN GRADING ORDINANCES Solids	Enforce existing requirements to control erosion during & following construction or grading	Public Works Caltrans	Implement for compliance 9/30/78	Marin County Code Sec 23.04.110 23.06.050 23.08	Institutional General Fund Property Tax Development Fee	Code as cited, enforced by Public Works	Flood prevention due to reduced siltation Air quality improvements thru dust control

TABLE 2 (CONTD)

SURFACE RUNOFF MANAGEMENT PLAN

RECOMMENDATIONS FOR URBAN CONTROL MEASURES, PHASE ONE

CONTROL MEASURE/and Pollutants Addressed	General Description	Implementing Agency (s)	Schedule of Action	Legal Authority	Financing Mechanism	Enforcement Regulation	Other Incentives
4.) REPAIR ROADS Solids	Repair chuck holes, etc., in street sur face	Public Works Caltrans	N. A.	Title 13 Title 3 Ch 3.12 Marin Co. Code	State Gas Tax Vehicle Code Fines Sales Tax	Continued main-tenance of ex-isting facilities by Public Works	Public safety
5.) IMPROVE ROADSIDE DRAINAGE	Debris removal, dredg-ing of culverts & drain pipe installation	Public Works Caltrans	N. A.	Marin County Code Title 3, Sec 3.12 Title 13, Sec 13.14	State Gas Tax Vehicle Code Signs Sales Tax General Fund Property Tax	Codes as cited Enforced by Pub-lic Works	Improve drainage & re-duce flood po-tential & road side erosion

TABLE 3

MARIN COUNTY SURFACE RUNOFF MANAGEMENT PLAN

WORK PROGRAM 1/1/78 - 6/30/78

TASK	Jan.	Feb.	Mar.	Apr.	May	June
1. Meet with each city and special district individually.						
2. Reactivate County Surface Runoff Technical Advisory Committee.						
3. Establish special subcommittees.						
4. Gather additional data on surface runoff pollution problems.						
5. Gather additional data on existing practices.						
6. Gather additional cost/financing data on Phase I control measures.						
7. Prepare Plan "revisions".						
8. Participate in regional SRMP activities.						
9. Continue monitoring program.						
10. Make new modeling runs.						
11. Prepare progress report.						

INTRODUCTION

II. INTRODUCTION

On October 18, 1972 Congress passed the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). Section 208 of this law requires that all urban-industrial areas in the country prepare water quality management plans. As a result, there are now over 170 such areas, nationwide, preparing so called "208" plans. Nationally, the United States Environmental Protection Agency (EPA) is charged with the administration of the 208 program. In the San Francisco Bay Area, the Association of Bay Area Governments (ABAG) is the agency responsible for preparing the areawide plan. To fund this effort, ABAG received a $4.3 million grant from EPA.

At the beginning of the program, ABAG proposed, and EPA agreed, to include in the plan other aspects of environmental management in addition to water quality. Accordingly, the plan will consist of not only a Water Quality Management Plan but also an Air Quality Maintenance Plan, a Solid Waste Management Plan, and a Water Supply Management Plan. Because the plan as a whole (all four management plans) will be so comprehensive and will integrate several aspects of environmental management, it will be entitled the "Environmental Management Plan for the San Francisco Bay Region" (EMP).

ABAG and its consultants are responsible for preparing all four management plans. However, the Water Quality Management Plan must, by law, include consideration of the pollution effects of storm water runoff. As the study of this subject required localized knowledge and public participation, ABAG decided that each county in the 208 study area (Alameda, Contra Costa, Marin, Napa, Santa Clara, San Mateo, Solano and Sonoma)* would prepare

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* San Francisco County was not included as it had previously prepared a SRMP.

a county Surface Runoff Management Plan (SRMP). Conclusions and recommendations from the eight individual County SRMPs would then be integrated into a single Regional SRMP. This Regional SRMP would then be the required section of the Water Quality Management Plan. Accordingly, the Marin County Surface Runoff Management Plan has no official status, either locally or regionally, except insofar as it is incorporated in the Regional Surface Runoff Management Plan.

In July, 1976 Marin County entered into a contract with ABAG wherein the County agreed to prepare the Marin County Surface Runoff Management Plan and, in addition, to carry out Data Collection and Public Participation Programs in support of the entire Bay Area 208 effort. To fund these programs, ABAG agreed to "pass through" to Marin County $99,160 of the original $4.3 million grant.

The Marin County Comprehensive Planning Department and the Department of Public Works coordinated the preparation of the SRMP. Policy direction has been from the Marin County Planning Commission at publicized hearings. Guidance and technical assistance has also been received from the Surface Runoff Plan Advisory Committee which consists of staff from City Planning and Public Works Departments and special district personnsl.

Preparation of the Marin Surface Runoff Plan has been focused on the following goals and objectives:

<u>Goals</u>

1. To achieve the greatest possible improvement in the quality of Marin County's surface runoff while being consistent with the available data and the present state of the art of pollution control.

2. To strike an appropriate balance between such improvement and the social, economic, political, environmental and practical constraints in Marin County.
3. To allow the problems to be locally determined, the solutions locally generated and the plan locally implemented.
4. To produce a plan with sufficient flexibility to allow for the necessary and inevitable refinements as more data become available and the state of the art is advanced.
5. To cooperate with the other eight Bay Area Counties in monitoring, prevention and/or treatment of problems which have regional significance.

Objectives

1. The preliminary location, identification and quantification of surface runoff pollution problems in Marin County.
2. The evaluation of existing and potential control measures for practicality, effectiveness and social, economic, political and environmental acceptability in Marin County.
3. The development of feasible financial and/or institutional implementation methods and procedures for those control measures which best meet the criteria of Objective #2.
4. The maximum possible input from and involvement of the local governments, agencies, institutions and public.
5. The development of a long term continuing planning process to allow for the refinement and updating of the plan and for the monitoring of the effectiveness of the implemented control measures.

Besides the formal objectives listed above, there was an informal, though

non-the-less recognized, objective. This was, simply, to learn as much as possible about the process and procedures of studying this problem. Surface runoff pollution is a fairly new area of concern and, as such, there has not been a large amount of previous research or planning in this field. Therefore, it should not be surprising that many problems arose in the course of making the study and preparing the plans. These problems were not only relative to the general lack of background data and quality criteria but also with disagreements between the various participating agencies and organizations over basic questions, e.g., what is a pollution "problem"; how much data is enough; regional versus local implementation, funding and enforcement. Many of these problems were not apparent at first and often required much discussion before they could be clearly defined. Some problems arose which were insurmountable, forcing those involved to seek other avenues of approach. Occasionally, what seemed a serious problem became a moot point with the acquisition of new information. In short, the preparation of the County SRMPs was as much a learning experinece as anything else. Working relationships were developed, basic questions and problems clearly defined and sometimes answered or solved, and, most importantly, a process was developed. As a result, future efforts at surface runoff pollution control in Marin County and the Bay Area will be easier.

SURFACE RUNOFF - PROBLEM DEFINITION

III. SURFACE RUNOFF - PROBLEM DEFINITION

A. METHODOLOGY

The first objective of the Marin County SRMP, as stated on page 12 was the:

"location, identification and quantification of surface runoff pollution problems in Marin County."

However, as previously stated, surface runoff pollution is a fairly new area of study, so there has not been a large amount of previous research on which to build. Indeed, data on several basic questions is wholly or substantially unavailable, e.g.,

--What are "unacceptable" levels of various substances in receiving waters?

--What is the capacity of a receiving body of water to assimilate pollutant loadings?

--What are "normal" levels of various substances in creeks, rivers, lakes and bays?

Without answers to such questions, it is most difficult to define just what a surface runoff pollution problem <u>is</u>, let alone to locate, identify and quantify them.

To overcome this problem, it was decided that several methods would be employed to study the quality of, and the problems caused by, surface runoff in Marin County. A very brief description of each method is given below. Detailed descriptions of the methods and their results are given in the referenced appendices.

-Compilation and examination of all past water quality studies and data for Marin County. As the field is quite new, very few studies have been made or data collected. (See Appendix A.)

-Sampling of streams during storms. This attempt was severely restricted by the drought but some data was obtained. (See Appendix B.)

-Comparison of surface runoff pollutant loadings with the loadings from "treated point sources" (sewage treatment plants). (See Appendix C.)

-Computer modeling. While this effort was somewhat restricted due to the lack of reliable local data, much was learned about modeling itself which should prove quite valuable in updating and revising the plan. (See Appendix D.)

-Field investigation. Field investigators observed day-to-day construction and land use practices in different parts of the County to see how they might cause a surface runoff pollution problem. While not scientifically rigorous, the effort was useful in identifying the types of activities the control measures would have to address, e.g., construction erosion, litter, overgrazing, etc.

-Identified water pollution problems. These problems were inventoried and then analyzed to determine if they were wholly or partially attributable to surface runoff pollution. (See Appendix E.)

B. EXISTING PROBLEMS

The success of the above listed methods on the "location, identification and quantification of surface runoff pollution problems in Marin County" was limited. A few specific problems were located and identified, but they are considered to be minor and only partially attributable to surface runoff pollution. In addition, the data obtained does indicate that several substances are present in

Marin's surface runoff in potentially harmful quantities and/or concentrations. However, the data base is so small, considering the complexity of the systems involved, that it is not possible at this time to determine the magnitude or seriousness of that potential.

Limited and inconclusive as they are, the results of the six methods do support the following conclusions:

1. There are no identifiable serious* pollution problems in Marin County resulting from surface runoff.
2. There are four minor specific problems in Marin County at least partially attributable to surface runoff pollution. These are:
   a. Richardson Bay occasionally experiences excessive algae growth that causes visual and odor nuisances as well as possible dissolved oxygen problems.
   b. Shellfish harvesting is prohibited in Richardson Bay due to bacterial contamination.
   c. All creeks in Marin's eastern urban corridor have excessive levels of nutrients which sometimes cause visual and odor nuisances.
   d. The reduction of the population of salmon spawning in Marin's creeks is at least partially attributable to excess nutrient levels and siltation caused by surface runoff.
3. Marin's surface runoff contains substantial quantities of suspended solids, BOD, nutrients and possibly bacteria and lead. These constituents are potentially harmful and may contribute to pollution problems in San Francisco Bay outside of Marin's borders.

* Requiring immediate remedial action

4. Several of Marin's water supply reservoirs are eutrophic (see Glossary). These are Nicasio, Alpine, Lagunitas, Phoenix and Stafford Lakes.

This last problem has not been addressed in this plan because eutrophication is a natural process, and any attempt to control it at its source (the land) would involve many complex ecological problems. Therefore, this problem is best dealt with in the reservoirs themselves. To this end, the North Marin County Water District has applied and qualified for a Clean Lakes matching grant and Marin Municipal Water District is in the process of doing the same. Therefore, since the problem is being adequately dealt with by the Water Districts, there was no need to consider it further in this plan.

C. FUTURE PROBLEMS

Because computer modeling was used in the study (see Appendix D), it was possible to examine what changes would take place in the quality of Marin's surface runoff due to future growth and development in the County. By substituting projected population and land use data for current data in the computer model, the model was able to calculate the pollutant loadings in Marin's runoff for the projected conditions. It was necessary, therefore, to make projections of just how much growth and development will take place in Marin County by the years 1985 and 2000 (the years selected for study). It was originally intended that these projections would be the "Series 3" projections for the Bay Area developed by ABAG. Unfortunately, difficulties arose with the Series 3 projections for Marin County, and so the projections used were based on, and extrapolated from the projections of the

Marin Countywide Plan.

Briefly, these projections indicate that there will be very little, if any, change in land use patterns (percent of total area in various land use categories) in Marin County by the year 2000. The major change will be in the percentage of the total area that will be developed. In the City Centered Corridor, the percentage of developed land will increase from about 29% of the total area to about 35%. In West Marin (the Inland Rural and Coastal Recreational Corridors), the percentage of developed land will increase from about 1.0% to about 1.7% of the total area.

The changes in the loadings of some substances in Marin's surface runoff resulting from these increases in developed area are presented graphically in Figure 2. These changes are not significant with respect to surface runoff pollution, and it is believed that the proposed plan will adequately address them.

It should be noted that probably the most significant effect of this increase in developed land will be the erosion of the construction sites as the development takes place. Accordingly, construction site erosion is specifically addressed by the recommended control measures.

PROJECTED ANNUAL SURFACE RUNOFF LOADINGS

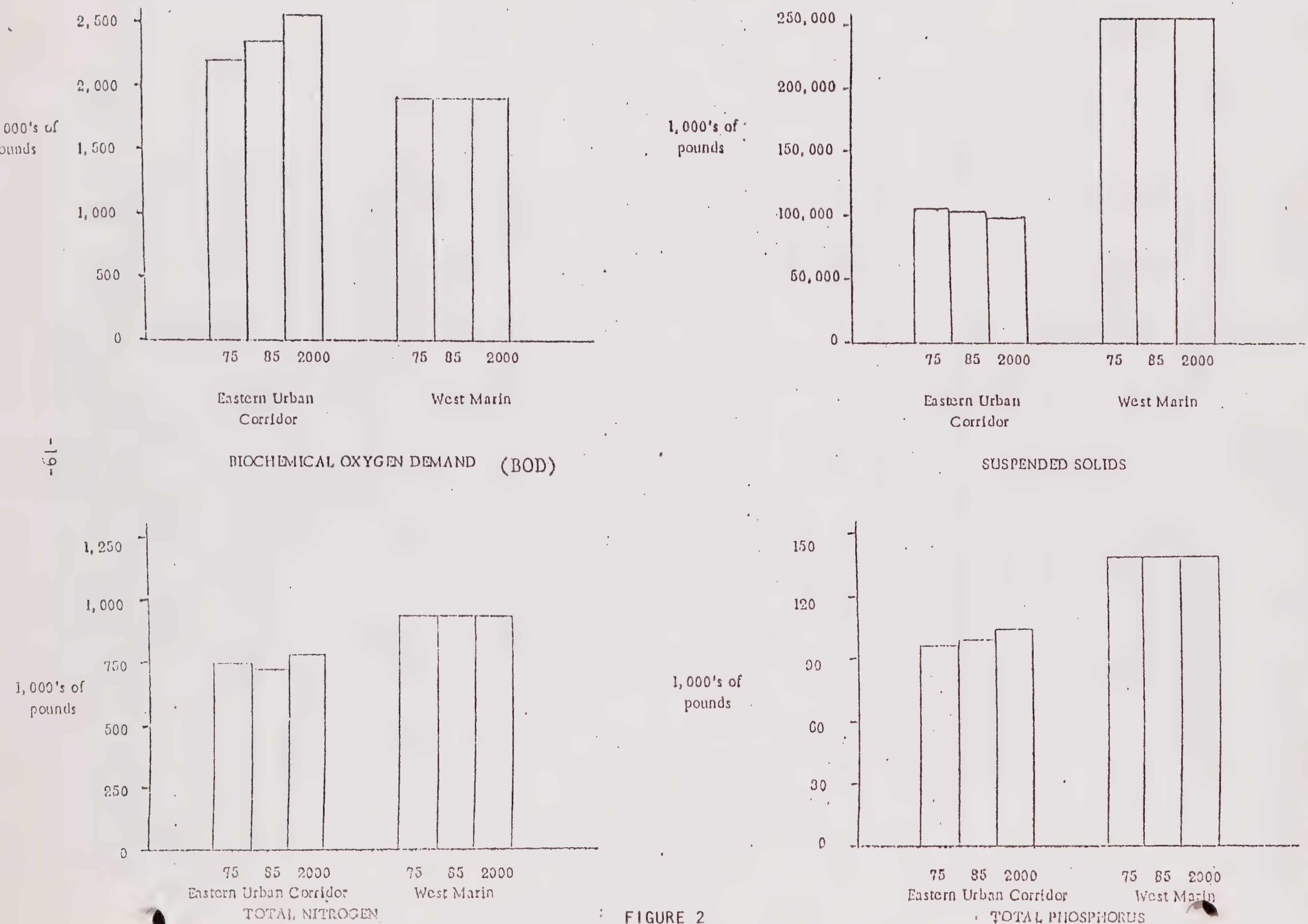


FIGURE 2

CONTROL MEASURES AND IMPLEMENTATION

IV. CONTROL MEASURES AND IMPLEMENTATION

A. General Discussion

After the problems had been determined, the next step was to select control measures to deal with them. Simply stated, control measures are procedures used to reduce the amount of one or more pollutants in surface runoff. This can be accomplished by several different methods such as: removing pollutants from the ground prior to storm runoff; preventing runoff from flowing over heavily contaminated areas; reducing the peak flow or volume of runoff; controlling certain land uses; or treating the runoff to remove pollutants. In all, a total of 60 control measures of all types were considered.

The selection of specific control measures for implementation was a rather complex procedure which involved both assessment and evaluation. The assessment concentrated on the development of information about the potential impacts of each control measure while evaluation used that information to determine which control measures were most appropriate to the situation in Marin County. A more detailed discussion of the Assessment Evaluation procedure is given in Appendix F.

B. Implementation

Phasing

In the process of deciding which control measures were most appropriate to the situation in Marin County, three facts had to be considered:

1. This plan is the initial step in a continuing planning process.
2. The data base is quite limited and the conclusions, therefore, tentative.

3. The first official date for the plan to be measured against its goals is July 1, 1983, which is approximately 5½ years from the date of plan completion.

A major conclusion to be reached from these facts is that the control measures should be implemented in a phased manner with the low-cost, easily implementable measures being implemented first and the more costly, troublesome ones only as their need is demonstrated. The goal date also suggests a three phase program with the first phase lasting 1½ years, and the second and third phases lasting two years each (see Figure 1). The first phase need not be as long as the other two, as the Phase I control measures do not require as much preparatory work and justification data as do the control measures recommended for Phases II and III. Each phase would begin with the determination of the need for certain control measures. The first year of each phase (9 months in Phase I) would be used for preparation work and at the end of that year, the selected control measures would be implemented. Actual implementation would not be instantaneous of course, but would take place during July, August and September, so as to be completed by the beginning of the rainy season. The second year would be spent gathering data to assess the efficacy of the implemented control measures. At the end of each phase, the surface runoff pollution situation would be reevaluated and new determinations made as to the need for additional control measures. At the end of the third phase, June 30, 1983, a determination would be made as to whether or not the interim goal of the Federal Water Pollution Control Act Amendments of 1972 had been met, i.e.,

"...water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water..."

In designing the phased implementation program, the control measures were classified according to a four-level system. Level One control measures are low-cost, easily implementable actions. Level Two control measures are still relatively low-cost but may involve other implementation problems. Level Three measures involve moderate costs and possibly some rather serious non-financial implementation problems. Level Four measures are high-cost methods with serious implementation problems. The Level One measures are recommended for immediate implementation and constitute Phase I of the plan. Level Two and Three control measures are meant to be implemented in Phases II and III respectively, and Level Four measures are last ditch efforts and will only be considered for implementation _if_ the July 1, 1983 goal is not met. A description of each level One control measure is presented in the following discussion of Recommended Control Measures. A list of Level Two, Three and Four Control Measures is presented in the Future Control Measures Section. It should be noted that several control measures from all levels are already in effect in some areas of Marin County. The main purpose of Phase I is to bring about as much uniformity in the application of existing control measures as is reasonable and to make sure those measures are utilized as efficiently as possible. It is _not_ recommended that those cities already implementing Level Two, Three or Four control measures abandon those efforts but rather that all cities and the County implement at least the Level One measures.

Responsible Agencies

The nature of the Phase I control measures is such that in most cases the implementing agency will be a City or County Department of Public Works Section, e.g., Road Maintenance, Building Inspection, Land Development. Police, Parks and Planning Departments may also be involved in a few cases. See the individual control measure descriptions for specifics.

Funding

All of the Phase I control measures are meant to be implemented within the context of existing programs and staff levels. No new programs or staff positions are recommended. Accordingly, the Phase I measures have only minor cost implications. Because of the low cost and the desire to keep the program under local control, it is recommended that all Phase I control measures, except Urban Control Measure #2, be funded by the Cities and County of Marin. Urban Control Measure #2 is intended to be funded at least partially by Federal and/or State grants.

Enforcement

As the Phase I control measures do not involve "enforcement" per se, what is referred to here is the enforcement of the SRMP itself. In other words, what happens if a city, special district, or the County fails to implement the Phase I control measures?

The Regional Water Quality Control Board (RWQCB) has the legal authority to enforce compliance with, and implementation of, the SRMP. This authority is derived from both State law (the Porter - Cologne Act) and Federal law (the Federal Water Pollution Control

Act Amendments of 1972). The RWQCB will not, however, take any enforcement action until at least after Phase I. Annual reports describing the progress made toward plan implementation will be prepared by the Marin County Comprehensive Planning Department and sent to the RWQCB. If after the second such report, some agency has clearly failed to implement the Phase I control measures, then the RWQCB will consider enforcement action.

By taking an active and responsible role now, local agencies can insure that "the problems will be locally determined, the solutions locally generated, and the plan locally implemented".

C. Control Measures and Implementation

The purpose of this Section is to describe Phase I control measures and a generalized work program for their implementation. As mentioned previously, the first half of each phase is to be spent in the preparatory work necessary before a given control measure can be implemented and the second half on monitoring the effectiveness of the implemented measures. Accordingly, the work outlined in this Section is meant to take place during the first half of Phase I, 1/1/78 to 9/30/78. If successful and on time, this work will result in the implementation of the Phase I measures in those areas of Marin County where they are not already in effect.

It should be noted that, to the extent possible under present City and County budgets, some Phase I measures are already in effect throughout the entire County. While the Plan does not make specific recommendations on these measures, they are included in the discussion

to draw attention to the need for their continued funding and to recommend review and possible improvement in the existing programs. The Urban Control Measure Matrix, Table 4, indicates the implementation status of the recommended urban control measures. The Matrix indicates by city:

1. Where an existing program is acceptable.
2. Where an existing program should be reviewed and any indicated improvements made.
3. Where a definite change or addition to an existing program will benecessary.

Lastly, it should be noted that the recommended control measures, both urban and rural, are considered to be "Best Management Practices" (see Glossary) and are not necessarily intended to solve specific problems. However, as the implementation of these measures will improve the general overall quality of Marin's surface runoff, they cannot help but reduce the identified problems. The magnitude of that reduction cannot be determined at this time, as the degree to which these problems are attributable to surface runoff pollution has not been determined.

The reader is referred to Tables 1 and 2 on pages 5 through 8 for a synopsis of the following descriptions.

TABLE 4

URBAN CONTROL MEASURE MATRIX

URBAN CONTROL MEASURE \ AGENCY	Marin County	Belvedere **	Corte Madera	Fairfax	Larkspur	Mill Valley	Novato	Ross	San Anselmo	San Rafael	Sausalito	Tiburon
Public Inform. Program	-		-	-	-	-	-	-	-	-	-	-
Parking Restrictions	-		-	-	-	+	-	-	-	+	+	-
Concentrate Sweeping	+*		+*	+*	+*	+*	+*	+*	+*	+*	+*	+*
Repair Streets	+		+	+	+	+	+	+	+	+	+	+
Clean catch and drains	+*		+*	+*	+*	+*	+*	+*	+*	+*	+*	+*
Enforce Erosion Controls	+*		+*	+*	+*	+*	+*	-	-	+*	+*	-
Improve Roadside Drainage	+*		+*	+*	+*	+*	+*	+*	+*	+*	+*	+*

- implementation required
+ existing program acceptable
+* review recommended
** no response

URBAN CONTROL MEASURES (CITY-CENTERED CORRIDOR)

1. Public Information Program

Over the long run, the most effective control measure for any type of pollution is public awareness, understanding and concern. To this end, it is recommended that a public information program, which specifically addresses surface runoff pollution, be carried out at both a regional and local level.

TV, radio and newspaper advertising are the most effective ways of reaching the general public. As a media oriented public information program would be most efficiently developed and implemented at a regional level, it is recommended that ABAG develop and fund such a program.

At the local level, it is recommended that a flyer be attached to all Building, Grading and Creek Permits issued by the Cities and County of Marin. This flyer would outline the procedures to be followed to prevent or control erosion and debris at construction sites. If the procedures are followed, suspended solids loadings and litter will be reduced.

The flyer will be developed by the County Department of Public Works and reproducible copies sent to each City DPW. Copying costs will be the responsibility of each City and should not exceed more than a few hundred dollars per year per City. Compliance will be enforced via the normal inspection procedure. Attachment of the flyer should begin by September 30, 1978.

2. Parking Restrictions for Sweeper Efficiency

Research has shown that the efficiency of a street sweeping program can be increased by as much as 800% if parking is prohibited on the streets when they are swept. Since urban streets are the main source of

heavy metals, oil and litter, as well as a major source of suspended solids, BOD, nutrients and bacteria, such an increase in sweeping efficiency could not help but have a significant effect on the quality of surface runoff from urban areas. Although all 11 cities and the County have street sweeping programs, only 3 cities have sweeping related parking restrictions (Mill Valley, San Rafael, Sausalito). It is therefore recommended that the remaining cities and the County adopt such restrictions.

Accordingly, early in 1978 representatives from City and County Public Works and Police Departments should meet and discuss how these restrictions are to be implemented and enforced. While the details will necessarily vary from city to city, the basic idea will be to enact these restrictions in all downtown areas, and possibly in any other areas that are swept on at least a weekly basis. Special seasonal restrictions might also be considered in residential areas to facilitate leaf pickup. While it may take quite a while to work out all the details, it is hoped that implementation will take place within fiscal year 78-79.

During the discussions, development and hearing process, a program to inform the public as to the need for these restrictions should be carried out. In addition, at the time of implementation, a concentrated effort should be made to inform the local public in each city as to the specifics of the restrictions in their city, i.e., when and where parking is to be restricted. This can be accomplished by direct mailing of flyers, public postings and newspaper advertisements. Continued notification will be accomplished by the installation of standard parking restriction signs along the streets affected.

When compared with the other Phase I control measures, the cost implications of this measure are rather high. Costs will, of course, vary from city to city depending on the sweeping schedule, the number of signs installed, enforcement, etc., and final determination of each city's costs will have to await the development process. Parking restriction sign purchase and installation will be the major cost item, however, and a rough estimate to purchase and install one sign is about $40.00, depending on the source and number purchased. A major source of funds for these signs will be State and/or Federal grants. Enforcement costs can hopefully be absorbed by existing police budgets with any over-run being offset by the increased parking fines.

Aside from the surface runoff pollution benefits, this control measures is desirable based on economic efficiency alone. Marin's smaller cities are at present spending between $15,000 and $20,000 <u>per year</u> on street sweeping while the larger cities spend $30,000 to $35,000 <u>per year</u>. An 800% increase in efficiency of these existing programs certainly justifies a <u>one time</u> expenditure of only 15% to 25% of the yearly sweeping ocsts.

3. Concentration of Sweeping Efforts in Highly Contaminated Areas.

As might be expected, commercial and industrial areas tend to generate more pollutants than do less intensively used areas. This is especially true of heavy metals, litter, oil and BOD. By sweeping these areas more frequently than the other areas, a greater overall efficiency in pollutant removal can be achieved.

This measure is presently in effect throughout the cities and County in that street sweeping is intensified during the fall months to accommodate the annual leaf drop. In addition, all commercial downtown areas of all cities and all major shopping center parking lots are swept daily. These

efforts should continue. In addition, it is recommended that City and County Public Works Departments review this aspect of their program to determine if improvements could be made. This review should be completed by September 30, 1978. Cost implications, if any, must await the results of the review before they can be determined.

4. Repair Streets.

Street repair aids in reducing the generation of pollutants in two ways. It keeps the street surfacing materials from decomposing and becoming part of the pollutants washed off during storms (note that asphalt and concrete pavements contribute to total solids loads and contain significant amounts of heavy metals). Repair also fills, seals or covers over areas which are eroded or collecting debris, which are later washed off by surface runoff. If there were fewer holes and crevices within which such material could accumulate, it would be easier to attain higher sweeper efficiencies.

Since street repair is at present a standard procedure in all cities and unincorporated areas of the County, no action or additional funding is recommended. However, because of the many benefits of street repair (safety, comfort, aesthetics, longer road life and surface runoff pollution control), it is recommended that it be considered as top priority during budgeting.

5. Clean Catch Basins and Storm Drains.

Catch basins contain a sump which allows for a "fallout" of the heavier objects in surface runoff, thereby removing them as potential pollutants. If the sump is allowed to become more than half full, however, material is washed <u>out</u> of the sump and the catch basin thereby becomes a <u>source</u> of pollutants. In addition, the storm drains themselves accumulate heavier sediments along their bottoms. If these accumulations are removed, it

not only prevents them from being washed into receiving waters but also allows for the more efficient operation of the storm drainage system. While this measure has some effect on nutrient and BOD loadings, the main effect will be on total dry solids loadings.

At present, all cities and the County have catch basin and storm drain cleaning programs. It is recommended that these programs be continued. It is also recommended that the City and County Public Works Departments review their cleaning schedule and inventory the basins and drains cleaned to make sure that their programs are as effective as possible. Upon completion of this review, all indicated improvements should be made, e.g., rescheduling or change in cleaning method. This review should be completed by September 30, 1978. Cost implications, if any, must await the results of the review.

6. Strict Enforcement of Erosion Control Requirements at Construction Sites.

In the preparation of a construction site, it is usual for a considerable amount of grading to take place. This results in the removal and/or disturbance of the natural ground cover. If the rainy season finds these areas still denuded or disturbed, a tremendous amount of erosion can occur. This is all too often the case in Marin County. This erosion can be controlled and/or prevented by many different methods (proper scheduling, reseeding, silting basins, straw cover, etc.). If these methods are implemented before the rains, a significant reduction in the total dry solids loadings in surface runoff can be achieved.

The County and almost all cities have existing grading ordinances which include erosion control requirements. Compliance, however, often

leaves much to be desired, and enforcement often takes place only after the fact, i.e., after the erosion has occurred. It is therefore recommended that City and County Public Works Departments review their erosion control enforcement policies and procedures, and also that they place a renewed emphasis on requiring erosion control measures <u>before</u> the rains actually start. This review, and any necessary policy or procedural changes, should be completed by September 30, 1978. As enforcement can be carried out under existing inspection procedures, there should be no cost implications for this recommendation.

In those cities where construction site erosion control is not addressed by local ordinance, it is recommended that the city adopt new or amend existing ordinances to require such controls. These ordinance changes or adoptions should be completed by September 30, 1978. Aside from minor staff time, printing and noticing costs, there should be no public cost implications as enforcement can be carried out under existing building inspection procedures.

7. Improve Roadside Drainage.

Roadways, being impervious surfaces, require drainage facilities. Such facilities can range from sophisticated curb, gutter and storm drain systems with catch basins, energy dissipators and engineered outfalls down to simple unlined roadside ditches draining to a creek. Generally the more sophisticated systems do not cause any pollution problems and, if properly designed and maintained, can even help control them (see Urban Control Measure #5). The simple unlined ditch, however, is another story. Besides the erosion of the ditch itself, the culverts used in conjunction with them are often installed in such a way as to cause erosion at the

outfall. In addition, these ditches cannot be reached by a street sweeper and so they become accumulators of and transport system for litter, leaves and other roadside debris. A roadway drainage system, in short, can be a source of pollutants itself, as well as a transport system for the pollutants.

It is, therefore, recommended that whenever road repair/improvement projects are scheduled by either City or County Public Works Departments, that any needed improvements to the roadside drainage system in the area be made part of the project. These improvements can take many forms ranging from the installation of curbs and gutters, to the lining of drainage ditches, to culvert realignment, to the installation of energy disappators at culvert outfalls. Costs will, of course, vary from project to project, and cannot be determined now. By including these improvements in other projects, however, the costs will be minimized. As this will be a continuing, long-term process, no target dates can be given.

Over the long run, these improvements can have a major effect on the quality of Marin's urban streams. Inadequate and improper roadside drainage was singled out by several knowledgeable persons as the major source of sediment in the creeks; and this sediment is at least partially the cause of the reduction in spawning salmon populations in our urban streams.

RURAL CONTROL MEASURES (INLAND RURAL AND COASTAL RECREATION CORRIDORS)

It should be noted that since all of the inland Rural and Coastal Recreation Corridors are unincorporated, the responsibility for implementing the following control measures lies with the County.

1. Public Information Program.

   See Urban Control Measure #1.

2. Performance Standards Within Water Supply Watersheds.

   There is increasing pressure in Marin County to allow development within municipal water supply watersheds. Should such development occur, it is imperative that it not adversely affect either the quality or the quantity of the runoff from the areas to be developed. Therefore, it is necessary to establish "performance standards" for any and all such development. These standards should require that any development within a municipal water supply watershed may not:

   a. Cause additional types and/or quantities of pollutants to enter any reservoir.
   b. Reduce the quantity of runoff from the area to be developed.

   It is therefore recommended that a committee be formed to develop these standards. This committee should include representatives from County Public Works, Planning, and Parks and Recreation Departments, County Counsel, Agricultural Commissioner, Farm Advisor, Resource Conservation District, Marin Municipal Water District and North Marin County Water District. In view of the fact that this issue is somewhat complicated, and differing opinions are sure to be encountered, it may take some time before the standards are actually adopted, but September 30, 1978 should be established

as a preliminary target date for adoption. Although there will be very little direct dollar costs involved, there will most certainly be considerable amounts of staff time necessary, as well as some material and printing costs. These should be shared by the County and Water Districts.

3. Strict Enforcement of Erosion Control Requirements at Construction Sites.

   See Urban Control Measure #6.

4. Repair Roads.

   See Urban Control Measure #4.

5. Improve Roadside Drainage.

   See Urban Control Measure #7.

D. Future Control Measures.

As discussed in the section on Phasing, all considered control measures were classified according to a four level system. The Level One control measures have already been discussed above. The purpose of this section is simply to list the other three levels of control measures. It should be remembered that these higher level measures are intended for implementation _only_ if their need is demonstrated. New data may modify, delete or add to the measures in each level. Final decisions as to which measures should be implemented and when, should be made at the beginning of each phase.

Urban Control Measures

Level 2:

1. Train operators in sweeper efficiency.
2. Increase frequency of sweeping.

3. Train work crews in the use of chemicals.
4. Strict enforcement of litter laws.
5. Establish recycling programs.
6. Eliminate cross-connections of storm drains with sanitary sewers.
7. Prohibit roof drains from entering storm drainage system directly.

Level 3:

1. Encourage inter-jurisdictional sharing of equipment and manpower for street sweeping and the cleaning of catch basins and storm drains.
2. Prohibit the use of certain chemicals.
3. Clean up vacant lots.
4. Prohibit sale of non-returnable containers.
5. Collect residential landscape debris.
6. Establish neighborhood composting areas.
7. Private horse grazing restrictions.
8. Eliminate existing connections of roof drains to storm drainage systems.
9. Require diversion of runoff around highly contaminated areas.
10. Regrade and revegetate disturbed areas.
11. Stabilize stream channels and banks.

Level 4:

These control measures generally involve a relatively high cost and are likely to encounter serious opposition to their implementation. They are only mentioned here as last ditch efforts to be considered only after July 1, 1983, and only after <u>conclusive</u> evidence for their need has been obtained.

1. Purchase new sweeping equipment.

2. Begin street flushing.

3. Retain runoff in highly contaminated areas.

4. Impound runoff in upstream channels.

5. Enahance surface runoff retention and infiltration.

6. Construct off-line storage (ponding).

7. Use excess capacity of sewage treatment plants.

8. Construct treatment facilities for surface runoff.

9. Control the use of autos.

10. Control land development patterns.

<u>Rural Control Measures</u>

Level 2:

1. Strict enforcement of litter laws.

2. Performance standards in all watersheds.

Level 3:

1. Prohibit the use of certain chemicals.

2. Prohibit sale of non-returnable containers.

3. Place restrictions on private horse grazing.

4. Regrade and revegetate disturbed areas.

5. Stabilize stream channels and banks.

6. Critical area planting.

7. Pasture and range management.

8. Conservation cropping system.

9. Woodland improvement (forestation).

Level 4:

These control measures generally involve a relatively high cost and are likely to encounter serious opposition to their implementation.

They are only mentioned here as last ditch efforts to be considered only after July 1, 1983 and only after <u>conclusive</u> evidence for their need has been obtained.

1. Diversion and ditches.
2. Conservation irrigation system.
3. Runoff and sediment control; ponds and basins.
4. Control land development patterns.

CONTINUING PLANNING PROCESS

CONTINUING PLANNING PROCESS

A. GENERAL DISCUSSION

As has been stated previously in this report, the Surface Runoff Management Plan is intended to be a continuing planning process. It is to fulfill that intention that the previously described phased approach to control measure implementation was adopted. Hand in hand with this approach goes the need for continued water quality monitoring and computer model refinement. While the long-term efforts in these three areas will have to await developments before they can be determined specifically, a general outline of the necessary work can be determined now and specific near-term efforts can be worked out. Taken together, the detailed near-term work program and the general long-term work outline for these three areas constitute the Continued Planning Process (See Figure 1 and Table 3).

B. CONTROL MEASURE IMPLEMENTATION

Control measure implementation has already been covered in the discussion on Phasing and the Recommended Control Measures Section and need only be summarized here. Over the next 5½ years (1/1/78 - 6/30/83), three phases will be completed. Each phase will start with the determination of whether or not additional control measures are needed, progress through the preparation, implementation and assessment of any needed control measures, and finally end with an evaluation of the efficacy of the control measures leading to a new determination of the need for additional control measures. It is expected that three phases will be enough, and the 7/1/83 interim goal of Public Law 92-500 will be met. If not, the phased program could continue until the goals are met.

C. MONITORING

Continued surface runoff water quality monitoring is necessary to build a data base to guide decision making, evaluate the efficacy of the implemented control measures and provide input data to the computer models. It is expected that monitoring will take place during each of the three phases with the effort being concentrated initially and diminishing as the data base builds up and knowledge expands.

Because the sampling program carried out during water year 76-77 was so restricted due to the drought (see Appendix B), the data base on surface runoff water quality in Marin County is still almost non-existent. Therefore, the sampling program for water year 77-78 is designed to provide as large a cross-section of data as possible relative to both parameters analyzed and areas sampled. To accomplish this, "grab samples" (See Glossary and Appendix B) will be taken from many different creeks and drainage systems throughout the County and they will be analyzed for many different parameters. Although the data from such samples will not be statistically reliable, it will provide the necessary background data on which to base future sampling programs. Such a "shotgun" approach also has the advantage of being quite flexible as to sampling locations which will be extremely important should the drought continue.

Because of the uncertainty of this season's rainfall and storm patterns, only potential sampling sites will be selected now. As the rains begin, the sites will be checked, and those experiencing runoff will be sampled. It is hoped that about 65 samples will be taken from both rural and urban areas and about 20 samples from areas of particular concern such as main highways and large parking lots.

At first all samples will be analyzed for the following parameters:

BOD	Mercury	Arsenic
Suspended Solids	Zinc	Selenium
Total Nitrogen	Copper	Boron
Total Phosphorus	Calcium	Phenols
Total Coliforms	Silver	Sodium
Fecal Coliforms	Chronimum	
Lead	Barium	

It is expected, however, that many of these parameters will either not be present at all, or in such minute quantities as to be of no concern. Of course, some parameters will be present in the samples from some areas and not in those from other areas. As the data is compiled, and a pattern emerges, the analysis list will be modified accordingly.

The actual sample gathering will be carried out by personnel from the Marin Municipal and North Marin County Water Districts. No new personnel or budgeting will be required. The analysis of the samples will be done by the North Marin County Water District under a contract with the County of Marin. The toal analysis cost for water year 77-78 will not exceed $11,000 (assuming all 150 samples are collected) and this will be paid for from remaining 208 grant funds.

In the years succeeding water year 77-78, it is expected that the sampling programs will be far less expensive. The funds for these programs will come from three sources.

1. Any remaining Marin County 208 grant funds.
2. Any additional 208 grant funds that may be forthcoming from EPA.
3. City, County or special district budgets.

D. MODELING

The Third area of the Continuing Planning Process is computer modeling. As explained in Appendix D, one of the Models, SWMM, could not be used in Marin County due to a lack of necessary local data. The use of the other model, MAC, while not eliminated, was restricted for the same reason. As the monitoring program provides more data, the models will be able to produce a more accurate picture of surface runoff pollution in Marin County. Since decisions concerning the need for more control measures will be based on these model produced pictures, it is very important that this additional modeling be done.

The modeling effort will be similar for each phase and will consist of two parts. The first part will be a more or less continuous effort to refine and update the land use and water quality input data. It is expected that the amount of effort expended on this part will decrease from phase to phase. The second part will take place at the end of each phase and will be the actual model runs to establish the surface runoff pollution situation in Marin County at that time.

The modeling will be carried out by the Marin County Comprehensive Planning Department in cooperation with the Department of Public Works. Costs will be minimal and should not exceed more than $1,000 per year on average. These funds will at first come from remaining Marin 208 funds and later from the County and any new 208 funds made available by EPA.

E. PLAN ADMINISTRATION - ANNUAL REVIEW

As outlined above, the Continuing Planning Process requires local coordination of control measure implementation, water quality monitoring and modeling. Local coordination will also be required to annually update the surface runoff plan and evaluate the effectiveness of the program. It is recommended that this coordination role remain with the Marin County Comprehensive Planning Department in conjunction with the County Department of Public Works. In addition, it is recommended that the Surface Runoff Advisory Committee be continued in order to provide an inter-jurisdictional approach to plan implementation. The committee includes staff from City and County Planning and Public Works Departments, as well as from special districts (water, mosquito abatement, resource conservation, etc.). This recommendation would require ½ an additional staff person. This position will be funded by current 208 funding through June, 1978. In addition, this plan recommends that County coordination on a regional basis be continued as part of the regional implementation of the EMP. The County Lead Agency Committee should continue to serve this function and serve as a forum for discussion of regional environmental planning issues.

FINAL
DRAFT

MARIN COUNTY SURFACE RUNOFF MANAGEMENT PLAN

APPENDICES

GLOSSARY

COUNTY OF MARIN
Comprehensive Planning Department
Department of Public Works

January, 1978

APPENDICES AND GLOSSARY

APPENDIX A

PAST DATA AND STUDIES

APPENDIX A

PAST DATA AND STUDIES

Review of past data and studies included personal and telephone interviews, responses to questionnaires, and library research; and covered the 25 sources listed below. Tables I and II summarize the most pertinent data discovered in this effort.

City of Belvedere	City of Ross
City of Corte Madera	City of San Anselmo
City of Fairfax	City of San Rafael
City of Larkspur	City of Sausalito
City of Mill Valley	City of Tiburon
City of Novato	

Bolinas Community Public Utility District

Marin County Department of Environmental Health

Marin County Flood Control and Water Conservation District

Marin Municipal Water District

North Marin County Water District

Marin-Sonoma Mosquito Abatement District

Regional Water Quality Control Board

California Department of Health

California Department of Fish and Game

United States Geological SUrvey

Water Resources Archives, University of California at Berkeley

Mr. Donald Engler - Creek Naturalist

Mr. Willis Evans - 25 years with State Fish and Game in Marin County now with United States Forest Service

Dr. Gordon Chan - College of Marin, Biology Department

TABLE I PAST STUDIES

Author	Title	Date	Area Covered	Purpose	Subjects	Significance to SRMP
Calvin Daetwyler Scripps Institute of Oceanography	Marine Geology of Tomales Bay	November 1966	Tomales Bay W/S	Investigate marine sedimentation in rift valley	Geology and Oceanography of Tomales Bay	Data on sedimentation of Tomales Bay
Bala & Strandgaard	Master storm drainage plan for Novato area	March 1965	Novato W/S	Develop a Master Storm Drainage Plan for Novato	Rainfall, runoff & flooding	Quantity and model input data, drainage patterns for Novato.
Crawford Marine Specialists, Inc.	Prelim study of siltation problems in Bel Marin Keys Lagoon	June 1970	Bel Marin Keys Lagoon	Sources & causes of silt in BMK Lagoon & necessary control measures.	Silting from W/S & from Bay	Background data on siltation in Marin.
George S. Nolte	Master Drainage & Sediment Control Plan for Lag. & Wlkr Crks W/S	July 1965	Lagunitas & Walker Creeks W/S	To assess drainage needs and land use changes.	Rainfall, Geology, land use, sedimentation.	Quantity and sedimentation data
McCreary-Koretsky Engineers	Downtown Tiburon W/S Drainage Study	July 1966	Downtown Tiburon & Reed School area	Investigate storm water runoff & develop drainage alt.	Runoff, existing drainage system, flood damage.	Quantity and Model parameter data.
Marin Municipal Water District	Report on Proposed Improvements of MMWD Facilities	August 1956	SE Marin	To plan for future water supply needs	Pop-consumption, water supply, treatment, transmission & storage.	Rainfall-runoff relation
Marin Municipal Water District	Adequacy of Existing Water Supply during Dry Weather cycles	January 1972	MMWD	To assess current supply & consumption relative dry years	Past dry weather runoff, present supply & consumption, projected consumption	Rainfall - Runoff Data
Ch_2M-Hill	Water Resources Management Study	April 1973	MMWD	To study & recommend a W.R.M. plan	Use, supply, additional sources	Rainfall - Runoff Data
State Water Resources Control Board	San Francisco Bay Basin Plan	April 1975	All Bay Area	To develop plan for water quality control in Bay Area	Quality problems & objectives, control measures, beneficial uses	Considerable data & background information. Problem identification.Qual. objtvs
Soil Conservation Service	Report for General Soil Map for Marin County	February 1967	Marin County	To identify & delineate geologic areas & soil patterns for Marin County.	Soil behavior & Limitations	Gives Soil/Geologic data for erosion input data.
Department of Water Resources	Special Report on Dry Year Impacts in California	February 1976	California	Assess impact of dry weather. Predict impact of continued dry weather.	Present condition, impacts, mitigating measures.	Can help to evaluate our sampling data.
Yarnell & Ron Engineers	EIR on proposed dredging of Coyote Creek	January 1973	Mouth of Coyote Creek	Study Env.Impact of dredging and disposal of spoils.	Standard required EIR subjects	Quality data on dredging spoils.
Yoder, Trotter & Orlob Associates	Master Storm Drainage Plan for town of Corte Madera	December 1970	Corte Madera	Develop recommendations for master SD plan.	Characteristics of flooding of Corte Madera.	SWMM used in study. Good quality data.
Kaiser Engineers	San Francisco Bay - Delta Water Quality Control Program	March 1969	All Bay Area	To study impact of waste & storm water on SF Bay & Delta & to dev.plan/qual.cont	Water resources,qual problems & Managemnt Modeling & socioeconomic aspects	Excellent data on almost all aspects of 208 Surface Runoff Program.
Madrone Associates	EIR Larkspur Ferry Terminal	July 1973	Mouth of Corte Madera Creek	Evaluate Env.Impact of constructing Ferry Terminal.	Standard required EIR subjects	Background data
Bala & Strandgaard	Mill Valley General Drainage Plan	April 1960	Mill Valley	Develop General Drainage Plan for Mill Valley	Review of past flooding, recommendations for upgrading system	Quantity and model parameter data
Regional WQCB	Long-Range Plan & Policy for Water Poll.Control for Bolinas/StinsonBh	April 1964	Bolinas-Stinson	To present detailed information for long range plan to control water pollution	Dischargers, quality & use, quality criteria resources.	Quality data on Lagoon
U.S. Army Corps of Engineer	Report for Flood Control & Allied Purposes for strm flwng Richardson B	April 1973	Richardson Bay Watershed	Investigate need for flood control project	Flood control, water conserv.,recreation, water pollution, protection wildlife	Good background data
	EIR Corte Madera Creek Flood Control Project	January 1974	Corte Madera W/S	Evaluate Environmental Impact of Corte Madera Creek Flood Control Project	Standard required EIR subjects	Good background data

TABLE II QUALITY AND QUANTITY DATA

Agency	Date	Location	Flow Data & Water Quality Parameter	Remarks
United States Geological Survey	11/71 to Present	San Rafael Cr at S.R.	Daily & Peak Discharge, Temp., Sediment loading and partical size	Sediment sampling done periodically.
	"	San Rafael Cr at Sirard Ln	" "	
	"	Irwin Cr Trib #1 at S.R.	" "	
	"	Irwin Cr Trib #2 at S.R.	" "	
	"	Irwin Cr at San Rafael	" "	
	5/67 to 9/69	Audobon Cr near Bolinas	" "	
	"	Morses Cr near Bolinas	" "	
	5/67 to 9/70	Pine Cr near Bolinas	" "	
	1946 to Present	Novato Cr at Novato	Daily & Peak Discharge	
	1951 to Present	Corte Madera Cr at Ross	" "	
	1965 to Present	Arroyo Corte Madera del Presidio at Mill Valley	" "	
	1962 to 1973	Redwood Cr near Tam Valley	" "	
	"	Nicasio Cr near Nicasio	" "	
	10/74 to Present	Lagunitas Cr below Nicasio Dam	" "	Dry weather makes this data useless
	10/75 to Present	San Antonio Cr about 1 mile below Hwy 101	" "	
	3/59 to 9/60	Arroyo Sausal near Marshall	" "	
	1959 to Present	Walker Cr near Tomales	Daily & Peak Discharge Sediment loading and size	Sediment sampling only since 1970
Department of Water Resources	10/19/73	San Antonio Cr near Mouth	ph, conductivity, temp., D.O., T.D.S., Turb, SS, Nutrients	All of these samples were taken during the dry season and are, therefore, not particularly pertinent to surface runoff.
	11/26/73	" "	" "	
	5/22/74	" "	" "	
	6/05/74	" "	" "	
	5/22/74	San Antonio Cr above Hwy 101	" "	
	6/05/74	" "	" "	
	5/22/74	Petaluma River above S.A.Cr.	" "	
	6/05/74	" "	" "	
	12/74	Novato, San Anselmo, Mill Valley, Mount Tamalpais	Short-duration, High-intensity rainfall	Good data for first flush/shock loading dat
State Department Of Public Health	4/50	Fitzhenry Cr & Black Rock Cr in Stinson Beach	Ph, Ca CO_3, Cl, SO_4, Na, Mg, Ca, Fe Al, F, NO_3, Mn, Total Solids	Very old data. Much land use change since then
	1951 to Present	Several locations in and around Tomales Bay and shellfish specimens	Total & Fecal Coliforms	Periodic sampling relative to commercial oyster bed operations
	6/57	25 locations in Corte Madera-Larkspur area on Corte Madera Cr.	D.O. and total coliforms	
State and County Department of Public Health	9/55, 1/64, 9/68 1/69, 6/70, 1/76 6/76.	11-15 locations around Bolinas Lagoon	Total and Fecal Coliforms, specific conductance, Ph.	Early data indicates bacterial contamination; later data show clearing
County Department of Public Health	12/71	11 sites along Eskoot Cr in Stinson Beach	Total and Fecal Coliforms, specific conductance, NH_3 + N, flow	Some contamination increasing downstream
	8/74 to 8/75	13 sites along 6 cr draining to Tomales Bay from Inverness	Total and Fecal Coliforms	
University of California at Berkeley	11/63, 4/69, 12/69	Bolinas Lagoon	Sediments	Info on Sediment partical size
[illegible] Resources Engr, Inc.	9/60 to 5/61	17 sites along San Geronimo Creek	Total Coliforms	Data indicates no problem at that time.
Marin County Flood Control	5/74 to 6/75	Warner Cr, San Marin Cr, Arroyo Avichi, 3 sites on Novato Cr. All in Novato	Temp, flow, D.O., CO_2, ph, $CaCO_3$, N P, Alkalinity, Acidity.	Tests done with Hach Kit.
Dr. Gordon L. Chan	1957 to Present	Six sites along Corte Madera Creek	Temp, Salinity, TDS, D.O., PO_4, NO_3 Turbidity and ph.	Not all sites have been sampled for the entire period and not all parameters at each site.

APPENDIX A

While no specific surface runoff pollution problems were identified by this method, some water quality parameters were identified as possibly problematic. By far, the parameter of most concern was suspended solids but BOD, nutrients, bacteria and heavy metals were also mentioned.

APPENDIX B

SAMPLING PROGRAM

APPENDIX B

SAMPLING PROGRAM

A comprehensive, two-tiered sampling program was designed to be carried out in Marin County during water year 76-77. Unfortunately, due to the drought,only 5% of Marin's normal runoff occured during this period. Accordingly, the sampling program was drastically curtailed. A detailed description of the original program is presented below followed by a discussion of the program carried out and the data obtained.

The Sampling Program as Designed

A major consideration in designing a water quality sampling program for Marin County was that the County is an extremely diverse geographic area. Containing more than 500 square miles of area, Marin County has over 3,000 miles of creeks. Greater than one third of the County is State of National park land and more than half is in agricultural use. A further consideration in developing the sampling program was the fact that little water quality data has been recorded for Marin County creeks. The only ongoing sampling programs are being carried out by the local water districts and concentrate on the quality of the water in the reservoirs. These samples are usually taken in the spring and again in the fall at almost all reservoirs in the County. A few samples are taken from streams entering the reservoirs but the vast majority are taken out of the reservoirs themselves. Therefore, considering the diverse geography of the County and the lack of information about water quality, it was difficult to estimate the extent of surface runoff related

pollution problems much less their nature or location. Accordingly, it was decided that a two-tiered approach to sampling would be the most effective way to gain a reliable assessment of surface runoff water quality in Marin County.

The first level of sampling was to involve two intensively sampled sites. "Intensive" sampling means taking complete sample sets at short time intervals over the duration of a storm. With this procedure, a picture of the variations in quality and quantity of runoff during a complete storm event would be obtained. By intensively sampling a site for 4 or 5 storms, it was hoped that a statistically reliable data base would be generated with which to calibrate the computer models.

Two locations were selected for the intensive sampling; the first, on Halleck Creek where it intersects Nicasio Valley Road; and the second, on Sleepy Hollow Creek where it intersects Green Valley Court. Halleck Creek is about eight miles long and has several smaller tributaries. It drains an almost unpopulated area of about 8.5 square miles. The upstream area consists of partially wooded, steep hills and the downstream area is rolling pasture land used by dairy herds. It was chosen because it is typical of both existing agricultural land and potentially developable land in Marin County. Besides being a water source for the dairy herds and wildlife, the creek drains to Nicasio Reservoir which is a primary source for the County's water. Sleepy Hollow Creek is formed by two smaller creeks which combine about 3/4 of a mile upstream from the sampling station. There is a total of about 3-3/4 miles

of waterway draining an area of about 2.33 square miles. The area is a valley with a relatively flat floor bordered by steep, sparsely wooded slopes. The upper slopes are almost totally in open space while the floor is almost completely developed in low density single family homes. It is typical of many of the residential areas of Marin County and also represents an "upper limit" of development for the County's remaining undeveloped areas. The beneficial uses of the creek are aesthetics, and as a habitat and water supply for the local wildlife.

Marin County contracted with the firm of Brelje and Race Laboratories to both collect and analyze the sample sets for the intensive sampling sites.

The second level of sampling involved spot checks at some 12 to 15 sites throughout the County. A "spot check" is simply a single sample set taken at a single site for a single storm. While not statistically reliable, the data from the spot checks would have at least been an indicator of the possible presence or absence of surface runoff pollution problems in Marin. The sites were selected to provide data on areas of particular interest such as industrial parks, virgin timber land, and parking lots.

The collection of the spot check sample sets was to be carried out by personnel from the Marin Municipal and North Marin County Water Districts. The laboratory analysis was to be performed by the North Marin County Water District.

The sample sets collected at Halleck and Sleepy Hollow Creeks (the intensive sites) were to be analyzed for:

B.O.D.

Suspended Solids

Volatile Suspended Solids

Dissolved Solids

Total Nitrogen

Total Phosphorus

Lead

In addition to the regular sample sets, a composite sample was also to be collected at the intensive sampling sites. A composite sample is a sample containing runoff collected over the entire storm duration. The composite samples were to be analyzed for:

C.O.D.

Fecal Coliforms

Fecal Streptococci

Total Coliforms

Total Identifiable chlorinated hydrocarbons

Mercury

Zinc

Cadmium

The samples taken in the countywide "spot check" program were to be analyzed for:

B.O.D.$_5$	Boron
Suspended Solids	Zinc
Dissolved Solids	Cadium
Total Kjedahl Nitrogen	Silver
Nitrate Nitrogen	Arsenic
Total Phosphorus	Selenium
C.O.D.	Chromium
Lead	Barium
Mercury	Sodium
Fecal Coliforms	M.B.A.S.
Fecal Streptococci	Phenals
Total Coliforms	

Total Identifiable Chlorinated Hydrocarbons

The Sampling Program as Carried Out

As stated previously, only 5% of Marin's normal runoff occured during water year 76-77. As a result, it was necessary to severely modify the designed sampling program. Since there was no flow in Halleck Creek, the sampling site located on it was abandoned. Also, because water district personnel were busy with drought related programs, the spot check program was dropped.

This left only the Sleepy Hollow Creek sampling site and sample sets were collected there during the storms of December 30, 1976, February 8, 1977 and March 15, 1977. In all a total of 35 sets were collected and analyzed. Table I below gives the average concentrations of several of the parameters analyzed.

TABLE I

Parameter	Average Concentration
$B.O.D._5$	4.4 mg/l
Suspended Solids	87 mg/l
Total Nitrogen	2.37mg/l
Total Phosphorus	.23 mg/l
Total Coliform	15,600 MPN/100 ml
Fecal Coliform	8,100 MPN/100 ml
Lead	.05 mg/l
Mercury	.001 mg/l
Chlorinated Hydrocarbons	.00001 mg/l
Cadium	.0056 mg/l
Chromium	.013 mg/l
Silver	.011 mg/l

While these average concentrations are based on 35 separate sample sets collected during 3 separate storms, they are still not very usable for model calibration. There are three reasons for this:

1. Since the samples were collected during the second year of a drought, it is reasonable to assume that pollutants would have had a longer than normal period of time to build up on the ground surface.
2. Because the few storms of water year 1976-77 were separated by abnormally long dry intervals, it again seems reasonable to assume a greater than normal build-up of pollutants.
3. Because of the extreme dryness of the hills, virtually all rain falling on open lands was absorbed. Thus all sampled

runoff was from only the streets which would imply greater than normal concentrations of street related pollutants.

Although there is some evidence that the above conditions would not cause greater than normal pollutant build-up and concentrations, there is not enough data at present to reach any final conclusions. In short, while the sampling data collected during water year 1976-77 will have meaning within the context of several years of data, it has very little meaning by itself. Be that as it may, the sampling data does indicate possible problems with suspended solids, bacteria, nutrients and lead.

The Continuing Planning Process includes a program of continued sampling and analysis of surface runoff in Marin County. As this program progresses and a local data base is established, it will become possible to use purely local quality data in the computer model.

APPENDIX C

SURFACE RUNOFF VERSUS TREATED POINT SOURCES

APPENDIX C

SURFACE RUNOFF VERSUS TREATED POINT SOURCES

In order to determine the severity of surface runoff pollution in Marin, a comparison was developed between the pollutant loadings from surface runoff and treated point sources. In Marin County, the only "treated point sources" are the sewage treatment plants operated by the various sanitary districts and all but two of these plants are located in the City-Centered Corridor of Marin County. The two plants in West Marin utilize spray irrigation or leach fields for disposal and do not have outfalls. Therefore, the comparisons of surface runoff and treated point sources could only be made for the City-Centered Corridor.

In comparing the pollutant loadings of surface runoff and treated point sources, two problems arose. First, the loadings from surface runoff occur only during the six rainy months while the treated point source loadings continue year round. Second, the boundaries of the MAC watersheds do not coincide with the boundaries of the sanitary districts. To overcome the first problem, the comparisons were made between <u>total</u> annual surface runoff loadings and the loadings from the treated point sources for a period of <u>180 days</u>. To solve the second problem, it was necessary to make the comparisons between "groupings" of MAC watersheds and sanitary districts. The groupings were as follows:

Group	MAC Watersheds	Sanitary Districts
Southeast Marin	Richardson Bay Corte Madera San Rafael	Richardson Bay Sausalito Tiburon Mill Valley Ross Valley San Rafael-San Quentin Las Gallinas-Marin Bay
Northeast Marin	Novato San Antonio	Novato-Hamilton

The loadings from surface runoff were computed by the MAC computer model and Figure 1 shows the comparisons of the loadings from the two sources for both southeast and northeast Marin.

An examination of the data presented in Figure 1 substantiates the conclusion that suspended solids appear to be Marin's main potential surface runoff pollutant. Figure 1 also indicates that B.O.D. and Total Nitrogen might also be problems.

COMPARISON OF POINT SOURCE AND SURFACE RUNOFF POLLUTANT LOADS

FOR SIX MONTH PERIOD

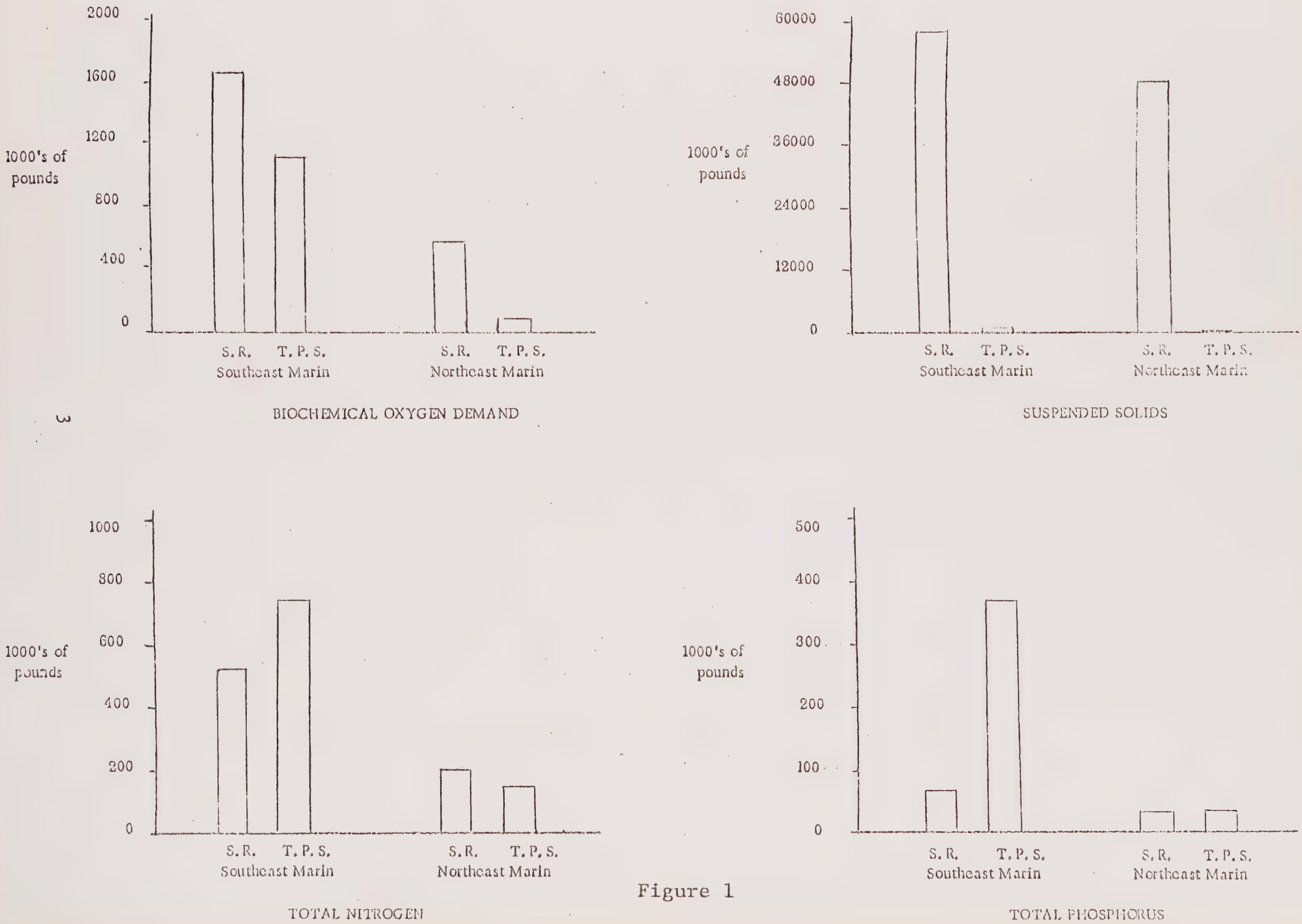


Figure 1

APPENDIX D

COMPUTER MODELING

APPENDIX D

COMPUTER MODELING

Originally, two computer models were selected for use in the 208 surface runoff pollution project; The Macroscopic Planning Model and the Storm Water Management Model. The first, called MAC, yields gross estimates of the pollutant loadings from large areas over long periods of time. The second model, called SWMM (pronounced SWIM), yields much more accurate estimates of the loadings but only for small areas and short time periods. It was intended that the models would be used interactively with MAC identifying the relative importance of major watersheds with respect to specific problems while SWMM could then provide a detailed examination of the identified trouble spots and, in turn, output data that would refine and improve the input data to MAC. By successive iterations of this process, an increasingly more accurate description of the quality of surface runoff could be produced.

Once an accurate description of surface runoff quality was produced, the SWMM model could then be used to determine the effect of different control measures. Alternatives could be tested on SWMM and the most cost-effective solutions determined.

However, since sufficient rainfall data was not generated this season, only the MAC model was used.

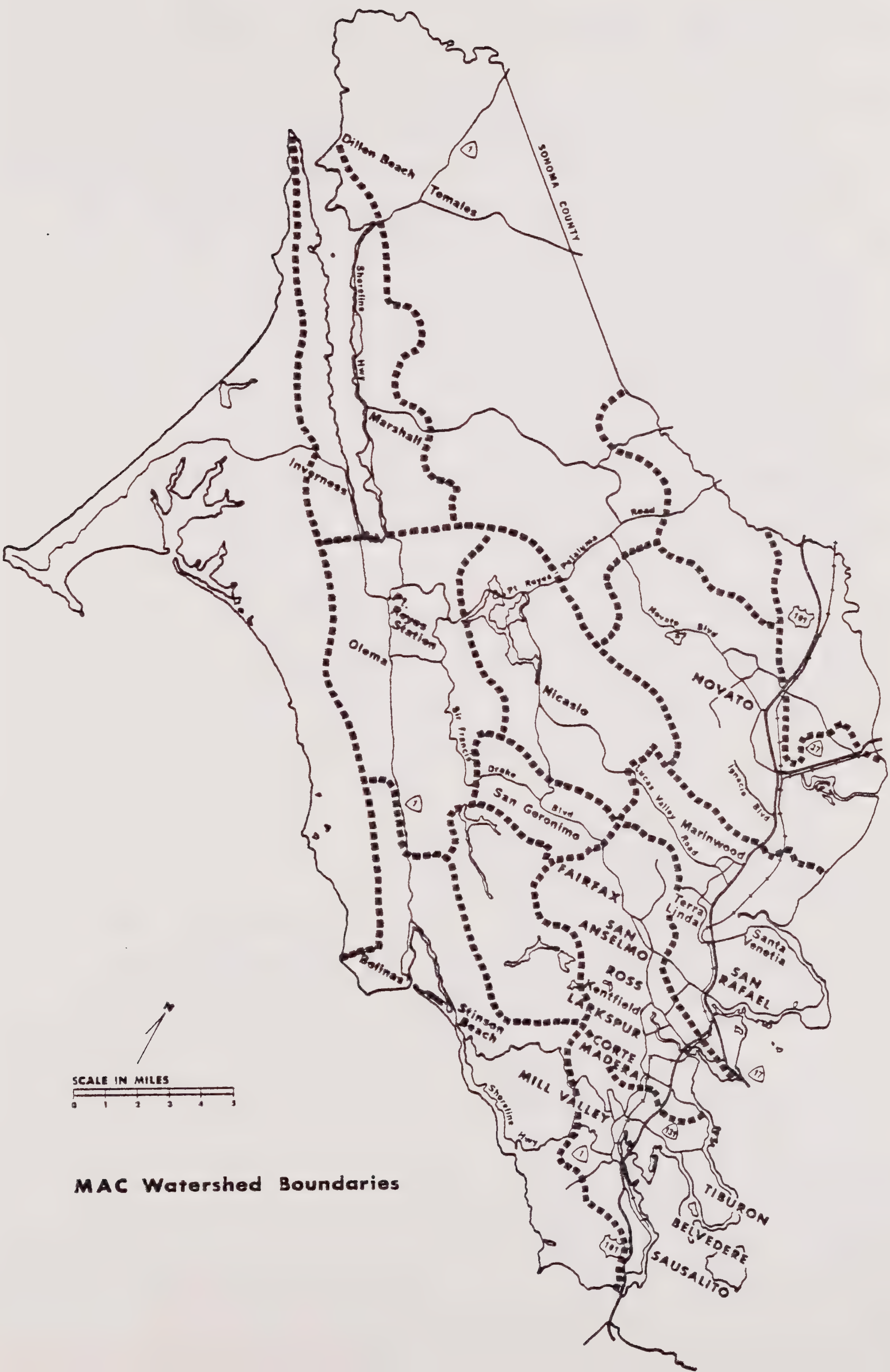
<u>The Macroscopic Planning Model, MAC</u>.

Since the purpose of MAC is to yield only gross estimates of pollutant loadings from large areas over long time periods, the input data need not be of a high order of accuracy and need only include

those hydrologic parameters which have a major effect on the quality or quantity of surface runoff. Specifically, the input data required by MAC to model an area are rainfall, runoff, land use distribution and water quality data.

To prepare the input data, Marin County was divided into 14 large watersheds as shown in Figure 1. For each watershed the number of acres in each of the following land use categories was determined: Single Family Residential, Multiple Family Residential, Commercial, Industrial, Open and Agricultural. Practically applied, the Open and Agricultural categories were considered as one category, Open/Agricultural. The runoff factor (the percent of rainfall that actually runs off) for each of the above land use categories was also estimated. Combined with the historical rainfall record, this information constituted three quarters of the input data required by MAC.

With the above described information, MAC was then able to calculate the theoretical amount of runoff from any or all of the 14 watersheds for any period of time from 1949 through 1975 (the period of rainfall records used). Several runs were then made for the Walker Creek Watershed and the Corte Mádera Creek Watershed, and the calculated theoretical runoff compared with the known runoff. The runoff from these two watersheds has been calculated from a United States Geological Survey gauging station on each of the creeks. The runoff factors for the various land use categories were then adjusted within reasonable limits until the calculated and actual runoff were within 5% of each other. The runoff



MAC Watershed Boundaries

factors thus obtained were then used for the remaining watersheds.

MAC could now calculate to acceptable limits of accuracy the quantity of runoff from Marin County. It could not, however, calculate the pollutant loadings resulting from that runoff. To accomplish this, it was necessary to provide MAC with the concentrations of various water quality parameters in the runoff from each of the land use categories, e.g., how many milligrams of suspended solids are contained in a liter of runoff from a commercial area. Obviously, such a figure would have to be an "average" concentration, as the actual concentration is dependent on an almost infinite number of variables. Such "average" concentrations were available based on the results of sampling programs throughout the U.S. These "national averages" were modified slightly based on the results of the local sampling programs (See Appendix B). The final concentrations used are shown in Table I below and Figure 2 shows a typical input data set.

Table I

Land Use Category	Pollutant Concentration in MG/L			
	BOD	SS	Total Nitrogen	Total Phosphorus
Single Family Residential	15	100	3.5	.4
Multi Family Residential	Dependent on Population Density			
Commercial	20	150	5.0	.7
Industrial	13	120	3.0	.5
Open/Agricultural	4	400-600	2.0	.3

RICHARDSON BAY R-X

LAND USE	AREA ACRES	K-FACTOR	POLLUTANT CONCENTRATION IN SURFACE RUNOFF, MG/L BOD	SS	VSS	TOT N	TOT P	OTHERS
RESIDENTIAL	4703.	.31	15.00	100.00	25.00	3.50	.40	0.00
RESIDENTIAL MULTI	823.	.35	10.40	211.50	123.00	7.00	.40	0.00
COMMERCIAL	400.	.75	20.00	150.00	70.00	5.00	.70	0.00
INDUSTRIAL	113.	.75	13.00	120.00	50.00	3.00	.50	0.00
OPEN	8282.	.26	4.00	400.00	60.00	2.00	.30	0.00
AGRICULTURE	0.	.15	.21	5.00	4.80	.11	.02	0.00
QUALITY OF WITHDRAWAL FROM STORAGE:								
TREATED			.21	5.00	4.80	.11	.02	0.00

TOTAL AREA ACRES	K-FACTOR OVERRIDE	STORAGE MIL GAL	WITHDRAWAL RATE MIL GAL/DAY	RAINFALL FACTOR	QUALITY OPTION
14321.0	0.000	0.0	0.0	1.30	0. RUNOFF

Figure 2

It was now possible for MAC to calculate the pollutant loadings from any or all of Marin's 14 watersheds for any period (day, week, month, year, years) from 1949 to 1975. However, since the pollutant concentrations used were averages, and because the purpose of MAC is to yield gross estimates, it was decided to use MAC to calculate the average yearly loadings for the entire 1949 to 1975 period rather than selecting some supposedly average single year. This was in fact done, and the results are presented in Table II. The loadings from the urban watersheds are broken down in Table II into developed and open (undeveloped) categories to provide some clue as to sources.

It was now also possible to calculate what the loadings would be at some future date. This was accomplished by substituting projected land use distribution figures for the 1975 figures in the input data file. Specifically, this was done for the years 1985 and 2000. The projections used were based on those of the Countywide Plan. The results of these runs were presented in Tables III and IV.

An examination of the modeling results presented in Tables II, III and IV leads to three conclusions:

1. Suspended solids are the most abundent pollutants in Marin County's runoff and the primary source of suspended solids is undeveloped land.
2. Developed areas produce considerably more BOD and nutrients per acre than undeveloped areas.
3. The changes in loadings over the next 25 years will not be significant.

MAC MODELING RESULTS FOR 1975

Watershed	Sub-Area	Area	Annual Pollutant Loads (1000's lbs)			
			BOD	SS	TN	TP
Richardson Bay	Developed	6039	290	2378	80	9
Richardson Bay	Open	8282	78	7819	40	5
Corte Madera	Developed	7252	472	3618	123	14
Corte Madera	Open	10681	125	12411	62	10
San Rafael	Developed	7872	496	3941	132	15
San Rafael	Open	13352	180	26854	89	13
Novato	Developed	5116	227	1739	59	7
Novato	Open	24202	223	33465	111	17
San Antonio	Developed	655	25	191	6	1
San Antonio	Open	10583	80	11972	47	6
Sub-totals for S.F. Bay Drainage Area		94034	2196	104388	749	97
Lagunitas	A1	28344	389	56695	192	28
Lagunitas	A2-4	35248	87	10832	43	7
Lagunitas	A3	6568	114	9344	46	6
Tomales Bay	A1	9791	74	8492	35	5
Tomales Bay	A2	12983	128	17651	61	9
Tomales Bay	A3	45315	422	62506	209	32
Point Reyes		44222	445	66671	223	34
Bolinas/Stinson	A	23481	220	27549	110	16
Bolinas/Stinson	C	927	30	832	8	1
Sub-totals for Pacific Ocean Drainage Area		206879	1909	260572	927	136
County Totals		300913	4105	364960	1676	235

TABLE II

MAC MODELING RESULTS FOR 1985

Watershed	Sub-Area	Area	Annual Pollutant Loads (1000's lbs)			
			BOD	SS	TN	TP
Richardson Bay	Developed	6633	326	2253	77	10
Richardson Bay	Open	7688	73	7259	36	5
Corte Madera	Developed	7520	501	3508	120	15
Corte Madera	Open	10413	121	12100	60	9
San Rafael	Developed	8359	552	3903	131	16
San Rafael	Open	12865	173	25874	86	13
Novato	Developed	5403	250	1757	60	8
Novato	Open	23915	221	33069	110	16
San Antonio	Developed	814	44	304	10	1
San Antonio	Open	10424	78	11794	40	6
Sub-totals for S.F. Bay Drainage Area		94034	2339	101821	730	99
Lagunitas	A1	28344	393	56543	192	28
Lagunitas	A2-4	35248	87	10821	43	7
Lagunitas	A3	6568	118	9240	47	6
Tomales Bay	A1	9791	75	8451	36	5
Tomales Bay	A2	12983	132	17482	62	9
Tomales Bay	A3	45315	425	62395	210	32
Point Reyes		44222	446	66656	223	34
Bolinas/Stinson	A	23481	220	27549	110	16
Bolinas/Stinson	C	927	32	764	9	1
Sub-totals for Pacific Ocean Drainage Area		206879	1928	259901	932	138
County Totals		300913	4267	361722	1662	237

TABLE III

MAC MODELING RESULTS FOR 2000

Watershed	Sub-Area	Area	Annual Pollutant Loads (1000's lbs)			
			BOD	SS	TN	TP
Richardson Bay	Developed	7342	363	2504	86	10
Richardson Bay	Open	6979	65	6590	32	5
Corte Madera	Developed	8282	560	3930	134	16
Corte Madera	Open	9651	112	11215	56	9
San Rafael	Developed	10111	686	4875	163	20
San Rafael	Open	11113	149	22352	75	12
Novato	Developed	6167	302	2137	72	9
Novato	Open	23151	213	32012	107	16
San Antonio	Developed	1466	54	375	13	1
San Antonio	Open	9772	73	11056	37	6
Sub-totals for S.F. Bay Drainage Area		94034	2577	97046	775	104
Lagunitas	A1	28344	399	56305	193	28
Lagunitas	A2-4	35248	88	10825	44	7
Lagunitas	A3	6568	123	9082	48	7
Tomales Bay	A1	9791	78	8389	36	5
Tomales Bay	A2	12983	138	17230	63	9
Tomales Bay	A3	45315	429	62225	211	32
Point Reyes		44222	447	66631	223	34
Bolinas/Stinson	A	23481	220	27549	110	16
Bolinas/Stinson	C	927	37	668	10	1
Sub-totals for Pacific Ocean Drainage Area		206879	1959	258904	938	139
County Totals		300913	4536	355950	1713	243

TABLE IV

The Stormwater Management Model, SWMM

This discussion of the SWMM model is presented for information, and it should be remembered that SWMM was not used in the preparation of this plan as was originally intended. There are two reasons why SWMM was not used. The first was that, due to the drought, it was not possible to collect sufficient local data to adequately calibrate the model. The second reason is that the main purpose of SWMM was to evaluate control measure alternatives for effectiveness. Since the research indicates no serious surface runoff pollution problems in Marin County, the control measures recommended in this plan are preventative in nature and meant to operate within the framework of existing practices. Given these two facts, it was not possible or necessary to use SWMM. A detailed discussion of the SWMM model is presented below anyway, because it is expected that SWMM will be used during the continuing planning process.

Since the purpose of SWMM is to yield accurate estimates of the pollutant loadings coming from a small area during a single storm, it is therefore necessary that the input data be as accurate as possible. To achieve this highlevel of accuracy for the input data, it is necessary to devide the watershed to be modeled on SWMM into "subcatchments". A subcatchment may be thought of as a small watershed contained within the larger one which is being modeled. The division must be done in such a way that each subcatchment has only one land use and is hydrologically homogeneous (constant ground slope, ground cover, etc.).

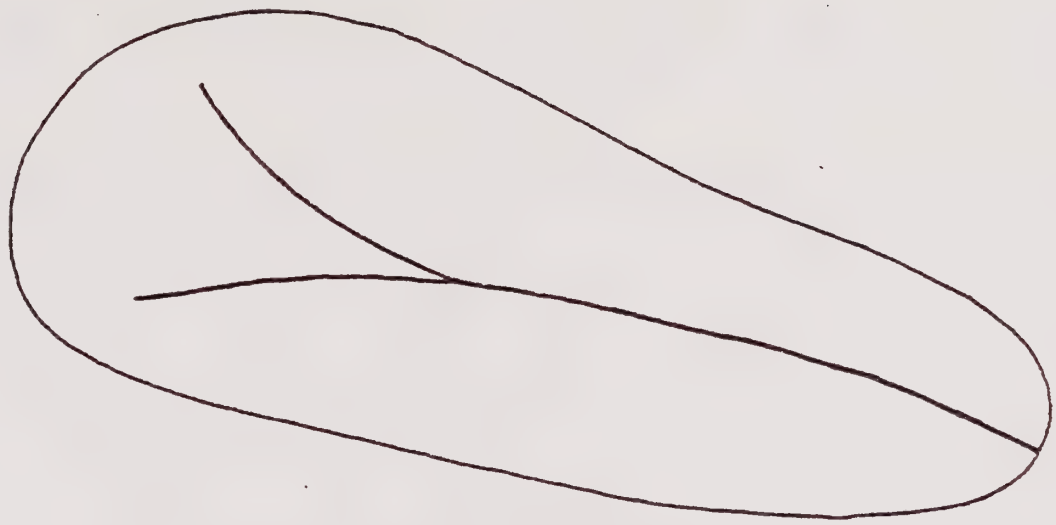
Utilizing and building upon the existing natural and man-made drainage system of the watershed, a theoretical drainage system of the watershed is then worked out whereby each subcatchment drains to a specific point or node in the theoretical system. These drainage nodes thus divide the theoretical drainage system into distinct sections terminated at each end by a node to which one or more subcatchments drain. Figure 3 is a simplified hypothetical example of this process.

Once this process is completed, the following information is then gathered for each subcatchment:

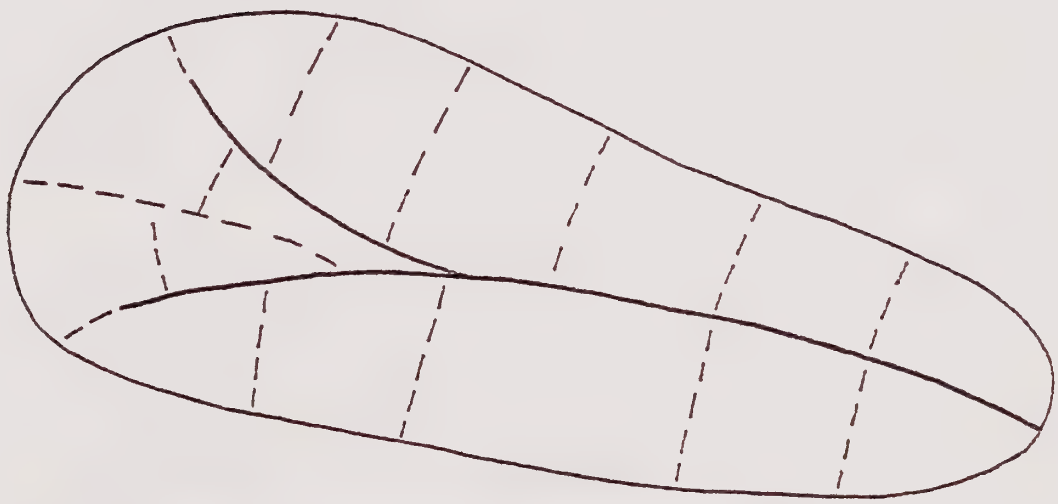
> Area, ground slope, width, average overland flow distance, percentage of impervious area, land use, miles of gutters, street sweeping frequency, soil types, and area subject to erosion. In addition, the following data is gathered for each drainage system section: Length, invert slope, bottom width, side slopes, manning coefficient and depth when full. These data may be obtained either from measurements on a small scale map or from field observations.

Combining the above information with historical rainfall records and quality coefficients similar to those described in the MAC model discussion, SWMM is able to calculate the mass emission rates from the modeled watershed for any storm of record and any pollutant. SWMM also utilized the Universal Soil Loss Equation so that natural erosion loadings are accounted for. The output takes the form of a graph which plots loading rates

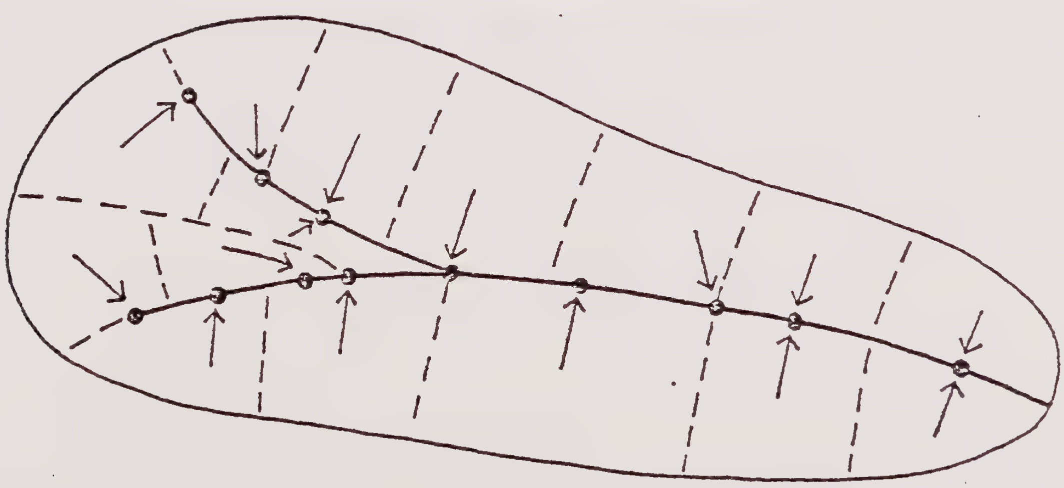
Watershed Division for SWMM Modeling



Existing Watershed System



Subcatchment Boundaries Added



Drainage Nodes Added

Fig. 3

(pounds of pollutant per second) against time for a specific storm. Figure 4 is a hypothetical example of such a graph.

Because SWMM calculates the variation in pollutant concentrations with storm durations, "average" concentrations are not suitable for calibration. In order to have field measurements to calibrate SWMM, it is necessary to actually take samples at a particular location every 15 minutes or so throughout an entire storm. Such a sampling procedure is known as "intensive" sampling, and it was originally intended that both the Halleck Creek and the Sleepy Hollow Creek sampling stations would be "intensively" sampled for 4 or 5 storms each. A detailed discussion of the sampling program is presented in Appendix B.

The real utility of SWMM, however, lies in its ability to evaluate different control measure alternatives. For example, since one of the inputs to SWMM is street sweeping frequency, it is possible to vary this input and by comparing the resulting loading rates, the most cost-effective sweeping schedule can be determined. As more data becomes available and if the need for additional control measures is demonstrated, it is expected that this ability of SWMM will be utilized extensively in Marin County.

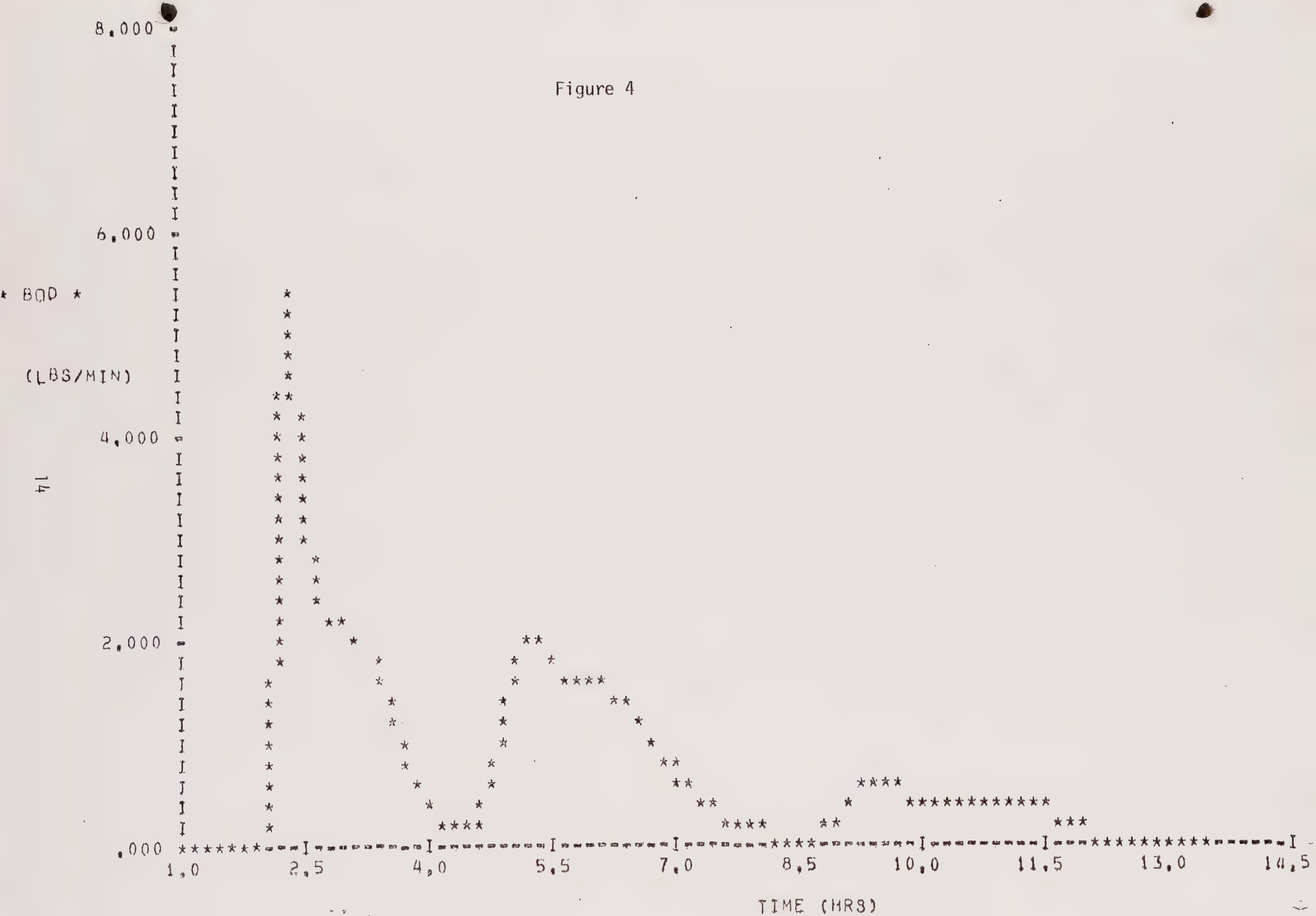

8,000
6,000
4,000
2,000
.000
* BOD *
(LBS/MIN)
1,0
2,5
4,0
5,5
7,0
8,5
10,0
11,5
13,0
14,5
TIME (HRS)

Figure 4

APPENDIX E

BENEFICIAL USES

APPENDIX E

BENEFICIAL USES

The term "pollution problem" can be defined in many different ways, and not everyone will agree on any one definition. However, one definition that most everyone could agree on is:

> Any loss or impairment of a beneficial use of a body of water due to a change in one or more water quality parameters.

Examples of beneficial uses include recreation, fish migration and habitat, shellfish propagation and esthetic enjoyment.

The existing and potential beneficial uses of 113 bodies of water in the San Francisco Bay Area were listed in the "Water Quality Control Plan for the San Francisco Bay Basin", prepared in 1975 by the State Water Resources Control Board and the California Regional Water Quality Control Board. This information is reproduced in Tables 1 and 2. Combining this information with the historical record, it was possible to determine which bodies of water in Marin County had impaired or lost beneficial uses and, therefore, by definition, pollution problems.

Other factors had to be considered, however, before the problems identified by this method could be considered as the legitimate concerns of the plan. For instance, in the process of analyzing these problems, it was determined that some of the problems have already been solved (the bacterial contamination of shellfish beds in Tomales Bay) while others were not attributable to surface run-off pollution in the first place (the bacterial contamination of Bolinas Lagoon).

Four problems were identified by this method as still existing and at least partially attributable to surface runoff pollution.

1. Richardson Bay occasionally experiences excessive algae growth that causes visual and odor nuisances as well as possible dissolved oxygen problems.
2. Shellfish harvesting is prohibited in Richardson Bay due to bacterial contamination.
3. All creeks in Marin's eastern urban corridor have excessive levels of nutrients which sometimes cause visual and odor nuisances.
4. The reduction of the population of salmon spawning in Marin's creeks is at least partially attributable to excess nutrient levels and siltation.

TABLE 1

BENEFICIAL USES

The following definitions for beneficial uses are applicable throughout the entire state.

Municipal and Domestic Supply (MUN)- Includes usual uses in community or military water systems and domestic uses from individual water systems.

Agricultural Supply (AGR)- Includes crops, orchard and pasture irrigation, stock watering, support of vegetation for range grazing and all uses in support of farming and ranching operations.

Industrial Process Supply (PROC)- Includes process water supply and all uses related to the manufacturing of products.

Industrial Service Supply (IND)- Includes uses that do not depend primarily on water quality such as mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization.

Groundwater Recharge (GWR)- Natural or artificial recharge for future extraction for beneficial uses and to maintain salt balance or halt salt water intrusion into freshwater aquifers.

Freshwater Replenishment (FRSH)- Provides a source of freshwater for replenishment of inland lakes and streams of varying salinities.

Navigation (NAV)- Includes commercial and naval shipping.

Water Contract Recreation (REC-1)- Includes all recreational uses involving actual body contact with water, such as swimming, wading, waterskiing, skindiving, surfing, sport fishing, uses in therapeutic spas, and other uses where ingestion of water is reasonably possible.

Non-Contact Water Recreation (REC-2)- Recreational uses that involve the presence of water but do not require contact with water, such as picnicking, sunbathing, hiking, beachcombing, camping, pleasure boating, tidepool and marine life study, hunting and aesthetic enjoyment in conjunction with the above activities as well as sightseeing.

Ocean Commercial and Sport Fishing (COMM)- The commercial collection of various types of fish and shellfish, including those taken for bait purposes, and sport fishing in oceans, bays, estuaries and similar non-freshwater areas.

Warm Freshwater Habitat (WARM)- Provides a warm water habitat to sustain aquatic resources associated with a warm water environment.

Cold Freshwater Habitat (COLD)- Provides a cold water habitat to sustain aquatic resources associated with a cold water environment.

Preservation of Areas of Special Biological Significance (ASBS)- Area of Special Biological Significance are those areas designated by the State Water Resources Control Board as requiring protection of species or biological communities to the extent that alteration of natural water quality is undesirable.

Saline Water Habitat (SAL)- Provides an inland saline water habitat for aquatic life resources. Soda Lake in the Central Basin is a saline habitat typical of desert lakes in inland sinks.

Wildlife Habitat (WILD)- Provides a water supply and vegetative habitat for the maintenance of wildlife.

Preservation of Rare and Endangered Species (RARE)- Provides an aqautic habitat necessary, at least in part, for the survival of certain species established as being rare and endangered species.

Marine Habitat (MAR)- Provides for the preservation of the marine ecosystem including the propagation and sustenance of fish, shellfish, marine mammals, water fowl and vegetation such as kelp.

Fish Migration (MIGR)- Provides a migration route and temporary aquatic environment for anadromous or other fish species.

Fish Spawning (SPWN)- Provides a high quality aquatic habitat especially suitable for fish spawning.

Shellfish Harvesting (SHELL)- The collection of shellfish such as clams, oysters, abalone, shrimp, crab and lobster for either commercial or sport purposes.

Hydropower Generation (POW)- Used for hydropower generation. No such sites are presently located in San Francisco Bay Basin.

Table 2. Existing and Potential Beneficial Uses of Surface Waters

	SURFACE WATERS	MUN	AGR	IND	PROC	GWR	FRSH	NAV	POW	REC1	REC2	COMM	WARM	COLD	ASBS	SAL	WILD	RARE	MAR	MIGR	SPWN	SHELL
1	Merced Lake	○									●			●			●					
2	Crystal Springs Lakes	●									●		●	●	○		●	●				
3	San Mateo Creek						●			○	○			○			●	●				
4	Pilarcitos Lake	●									○			●	○		●	●				
5	Pilarcitos Creek	●	●							○	○			●			●	●		●	●	
6	San Andreas Lake	●									●		●	●	○		●	●				
7	San Vicente Creek		●							○	○			●			●	●		●	●	
8	Denniston Creek		●							●	●		●	●			●	●		●	●	
9	Frenchmans Creek		●							●	●			●			●	●		●	●	
10	Purisima Creek		●							●	●			●			●	●		●	●	
11	Lobitas Creek		●							●	●			●	○		●	●		●	●	
12	Tunitas Creek		●							○	○			●	○		●	●		●	●	
13	San Gregorio Creek		●							●	●		●	●			●	●		●	●	
14	Pescadero Creek		●							●	●			●	○		●	●		●	●	
15	Searsville Lake		●							●	●		●	●			●					
16	Felt Lake		●							●	●		●				●					
17	San Francisquito Creek									○	○		●	●			●			●	●	
18	Stevens Creek Reservoir	●				●					●		●	●			●			●	●	
19	Stevens Creek						●			●	●		●	●			●			●	○	
20	Calero Reservoir	●				●				●	●		●				●					
21	Almaden Reservoir	●				●				●	●		●				●					
22	Guadalupe Reservoir	●				●				○	○		●				●					
23	Lake Elsman	●									○			●			●					
24	Campbell Percolation Ponds					●							●	●			●					
25	Lexington Reservoir	●								●	●		●	●			●					
26	Vasona Reservoir					●				●	●		●	●			●					
27	Cotton Wood Lake									●	●		●	●			●					
28	Los Gatos Creek	●				●	●				○			●			●			○	○	
29	Sandy Wool Lake										●		●	●			●					
30	Guadalupe River									○	●		●				●			○	○	
31	San Felipe Creek									○	○		●	○			●					
32	Coyote Reservoir	●	●							○	○		●	●			●					
33	Anderson Reservoir	●				●				●	●		●	●			●					
34	Cherry Flat Reservoir	●	●							○	○		●				●				●	
35	Coyote Creek									○	●		●	●			●	●		●	●	
36	Arroyo De La Laguna[1]					●				●	●		○	○			●			●	●	
37	Shadow Cliffs Reservoir									●	●		●	●			●					
38	Arroyo Del Valle[1]	●				●				○	○			●			●			○		
39	Del Valle Reservoir	●								●	●		●	●			●					
40	Alameda Creek		●			●				●	●		●	●			●			○	○	
41	Elizabeth Lake										●		●	●			●					
42	Arroyo Hondo[1]	●					●			●	●		●	●			●				●	
43	Calaveras Reservoir	●									○		●	○			●					
44	San Antonio Reservoir	●									○		●	●			●					
45	Cull Canyon Reservoir									●	●		●	○			●					
46	San Lorenzo Creek[1]									●	●		●	●			●			●	●	
47	San Leandro Reservoir	●									○		●	●			●					
48	Lake Chabot	●									●		●	●			●					
49	San Leandro Creek						●			○	○		○	●			●			○	○	
50	Lake Temescal									●	●		●				●					
51	Lake Merritt									●	●		●	●			●					
52	Briones Reservoir	●								○	○		●	○			●					
53	San Pablo Reservoir	●								●	●		●	●			●					
54	Lafayette Reservoir	●								●	●		●	●			●					
55	Pinole Creek									○	○		●	●			●			●	●	
56	Walnut Creek[1]									○	○		●	●			●					
57	Mallard Reservoir[2]	●	●	●	●						○		●				●					
58	Marsh Creek									○	○		●				●	●				
59	Marsh Creek Reservoir									○	○		●				●	●				
60	Contra Loma Reservoir[2]	●	●	●	●						●		●	●			●					
61	Lake Curry	●									○		●				●					
62	Lake Madigan	●	●								●		●	●			●					

Table 2. Existing and potential Beneficial Uses of Surface Waters (continued)

	SURFACE WATERS	MUN	AGR	IND	PROC	GWR	FRSH	NAV	POW	REC1	REC2	COMM	WARM	COLD	ASBS	SAL	WILD	RARE	MAR	MIGR	SPWN	SHELL
63	Lake Frey	●									●		●				●					
64	Suisun Creek									○	○		●	●	○		●			●	●	
65	Suisun Slough									●	●		●		○		●					
66	Montezuma Slough									●	●		●		○		●	●				
67	Lake Herman	●									○		●	●			●					
68	Chiles Creek	●					●			○	○		●	●			●					
69	Sage Creek	●					●			○	○		●	●			●					
70	Lake Hennessey	●									●		●	●			●				●	
71	Conn Creek	●					●			●	●			●			●			●	●	
72	Rector Reservoir	●									●		●	●			●					
73	Milliken Reservoir	●									○		●				●					
74	Lake Marie	●	●							○	○		○				●					
75	Lake Chabot	●	●							●	●		●	●			●					
76	Dry Creek	●	●							●	●			●	○		●			●	●	
77	York Creek									○	○			●			●			●	●	
78	Napa River	●	●					●		●	●		●	●	○		●	●		●	●	
79	Sonoma Creek									●	●		●	●	○		●	●		●	●	
80	Petaluma River							●		●	●		●	●	○		●	●		●	●	
81	San Antonio Creek									○	○		●	●	○		●			○	○	
82	Stafford Lake	●									●		●	○			●					
83	Novato Creek	●								○	○		○	○			●			○	○	
84	Rodeo Lagoon									●	●			●			●					
85	Miller Creek									○	○		●	●			●	●		○	○	
86	Lake Lagunitas	●									●		●	●			●					
87	Bon Tempe Lake	●									●		●	●			●					
88	Alpine Lake	●									●		●	●			●					
89	Kent Lake	●									●		●	●			●					
90	Lagunitas Creek									●	●			●	○		●	●		●	●	
91	Phoenix Lake	●									○		●	●			●					
92	Nicasio Creek	●					●			●	●			●			●			●	●	
93	Nicasio Reservoir	●					●				○		●				●					
94	Olema Creek									●	●			●			●			●	●	
95	Walker Creek									○	○			●	○		●	●		●	●	
96	Crystal Lake									○	○		●				●					
97	Pacific Ocean			●				●		●	●	●			●		●	●	●	●	●	●
98	South Bay			●				●		●	●	●			●		●	●	●	●	○	●
99	Lower Bay			●				●		●	●	●			○		●	●	●	●	○	●
100	Central Bay			●	●			●		●	●	●			○		●	●	●	●	●	●
101	San Pablo Bay			●				●		●	●	●			○		●	●	●	●	●	●
102	Suisun Bay & Lower San Joaquin			●	●			●		●	●	●			○		●	●	●	●	●	
103	Delta			●	●			●		●	●	●	●		○		●	●		●	●	
104	Bolinas Lagoon									●	●	●			●		●	●	●	●	●	●
105	Drakes Estero									●	●	●			●		●	●	●		●	●
106	Limantour Estero									●	●	●			●		●	●	●		●	●
107	Tomales Bay									●	●	●			●		●	●	●	●	○	●
108	San Pedro Creek										●		●	●			●			●	●	
109	Pomponio Creek		●							○	●			●			●			●	●	
110	Corte Madera Creek									○	●			●			●	●				
111	Old Mill Creek										●			●			●					
112	Pine Gulch Creek	●									●			●			●			●	●	
113	Kimball Reservoir	●									○		●				●					

NOTES:

1. Includes Upstream Tributaries.
2. Offstream Reservoir

○ Potential Beneficial Use.

● Existing Beneficial Use.

APPENDIX F

ASSESSMENT/EVALUATION PROCEDURE

APPENDIX F

ASSESSMENT/EVALUATION PROCEDURE

Impact assessment provides information on the environmental, economic, social, institutional and financial effects of plans, programs and projects. Experience shows that developing a plan and writing an after-the-fact EIR often results in identifying impacts that jeopardize plan implementation or require costly reengineering and replanning. A more efficient and meaningful approach to plan development integrates assessment and planning. Such an approach allows the weighing of environmental, economic and social benefits and costs of alternative solutions to our air, water and solid waste problems.

This integrated approach was utilized in the development of the Marin County Surface Runoff Management Plan. Within this context, the following definitions of assessment and evaluation apply:

- Assessment concentrates on developing information about the potential impacts of alternative plans.
- Evaluation involves the use of that impact information by decisionmakers in judging, selecting and adopting the plan(s).

Three main tools were used in the assessment of control measures: The Assessment Checklist; the Surface Runoff Control Measure Assessment Matrix; and the Assessment Worksheet.

The Assessment Checklist, developed with the aid of public input,

displays factors considered important in assessment and evaluation of pollution control measures. Organized into four broad categories--Environmental, Institutional and Financial, Economic, and Social--the Checklist indicates the potential types of impacts that might be associated with environmental control measures. The purpose of the Checklist, as the name implies, was simply to make sure that no potential impacts were overlooked in the assessment of any specific control measures. The entire Checklist is presented at the end of this Appendix.

The four broad categories of the Checklist are broken down into 16 subcategories, and it is on these that the second tool of the Assessment Procedure, the Surface Runoff Control Measure Assessment Matrix, is based. Shown in Table 1 the Matrix lists the 16 subcategories (row) and the candidate control measures (column). Each control measure was ranked on a four level scale against each assessment subcategory. The rankings on the matrix and their definitions are:

A = direct, substantial, immediate and significant impact; requires quantitative analysis if possible.

B = direct or indirect impact that might be significant; requires quantitative analysis if possible to determine if impact is significant.

C = indirect impact that is marginal, minor; qualitative discussion is required.

\- = no significant relationship; no detailed discussion required.

TABLE 1 ASSESSMENT MATRIX

ASSESSMENT / CONTROL MEASURE	Air Quality	Water Quality	Physical Resources	Energy	Amenities	Institutional	Financial	Prod. of goods services	Income/ Invest.	Consumer Expend.	Housing Supply	Physical Mobility	Health/ Safety	Sense of Community	Urban Pattern/ Landuse	Equity
U[illegible]																
Public Information Program (1)	-	A	B	B	A	C	C	C	-	-	-	-	C	A	-	-
Parking Restrictions for Sweeper Efficiency (2)	-	A	B	B	B	C	B	C	-	-	-	B	-	B	-	-
Concentrate Sweeping in Highly Contaminated Areas (3)	C	A	C	C	C	C	B	C	-	-	-	-	-	B	-	-
Repair Streets (4)	C	A	C	C	C	C	C	-	-	-	-	C	C	C	-	-
Clean Catchment Basins (5)	C	A	C	C	C	C	C	-	-	-	-	C	-	-	-	-
Clean Storm Drain System (6)	C	A	C	C	C	C	C	-	-	-	-	C	-	C	-	-
Enforce Erosion Control Requirements in Grading Ordinances (7)	C	A	C	-	C	B	-	-	C	-	C	-	C	C	-	-
Improve Roadside Drainage to Prevent Erosion (8)	C	A	C	-	C	C	C	-	-	-	-	-	C	-	C	-
Open Space Management (9)	-	A	B	-	A	C	B	-	-	-	A	C	B	A	A	B
RURAL																
Public Information Program (1)	-	A	B	C	A	C	C	C	-	-	-	-	C	A	A	-
Performance Standards Within Municipal Water Supply Watersheds (2)	-	A	B	-	C	B	-	-	-	-	B	-	B	A	A	B
Enforce Erosion Control Measures in Grading Ordinances (3)	C	A	C	-	C	B	-	-	C	-	C	-	C	-	C	-
Repair Roads (4)	C	A	C	C	C	C	C	-	-	-	-	C	C	-	-	-
Improve Roadside Drainage to Reduce Erosion (5)	C	A	C	-	C	C	C	-	-	-	-	-	C	-	C	-
Open Space Management (6)	-	A	B	-	A	C	B	-	-	-	A	C	B	A	C	B
Support CRWQCB Guidelines For The Protection of Water Quality from Animal Wastes (7)	-	A	B	C	A	-	B	C	B	B	-	-	A	A	C	B
Control Chemicals (8)	-	A	A	C	A	C	C	C	-	C	-	-	A	-	-	C

A = direct, substantial, immediate and significant impact
B = direct, or indirect impact that might be significant
C = indirect impact that is marginal or minor
- = no significant relationship

These rankings were derived by the use of the third assessment tool, the Assessment Worksheet. Shown in Figure 2, this Worksheet provided a means to detailed impact identification. Based on the totality of the information on the worksheet, the letter rankings used on the matrix were established.

After completion of the entire Assessment Procedure, the data obtained and systematized was then used for the evaluation of each control measure. This evalution took the final form of the four level division of the control measures as discussed in the main report in the Implementation Section on Page 20.

ASSESSMENT WORKSHEET

Answer the following questions by checking the appropriate box(es); consider the activity, construction, operation, and other indirect impacts.

CONTROL MEASURE ______________________________

ASSESSMENT FACTOR Physical Resources - Prime, Unique, Other Agricultural Lands

WOULD THE CONTROL MEASURE HAVE AN IMPACT ON PRIME, UNIQUE OR OTHER AGRICULTURAL LANDS OR PRODUCTION ACTIVITIES? _______ YES _______ NO Sources/Reason ______________

____

____

If YES, specify the nature of impacts on:

	Direct	Indirect	Minor	Moderate	Severe	Reversible	Irreversible	Quantifiable	Qualitative	Adverse	Beneficial
prime agricultural lands? Source(s) ______________	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
other agricultural lands? Source(s) ______________	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
lands in agricultural preservation zones? Source(s) ______________	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
lands producing/capable of producing unique/speciality crops? Source(s) ______________	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
lands supporting/capable of supporting livestock? Source(s) ______________	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
lands producing or capable of producing fruit or nut bearing trees, vines, bushes, crops? Source(s) ______________	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 2

	Direct	Indirect	Minor	Moderate	Severe	Reversible	Irreversible	Quantifiable	Qualitative	Adverse	Beneficial
lands which have returned from production of unprocessed plant products an annual gross value of $\geq$ \$200/acres for 3 of previous 5 years? Source(s)________________________________ ____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
production activities associated with the particular enterprise (Specify) Source(s)________________________________ ____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
environmental conditions/characteristics necessary to the agricultural activity or which might affect crop viability? Source(s)________________________________ ____	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

****

Explanation/Notes

Figure 2 - continued

ASSESSMENT CHECKLIST

I. ENVIRONMENTAL CRITERIA

A. Air Quality

1. Federal standards for air quality
   - Total suspended particulates
   - Carbon monoxide
   - Photochemical oxidants
   - Hydrocarbons
   - Sulfur dioxide
   - Nitrogen dioxide

2. State standards for air quality
   - Lead
   - Sulfate
   - Hydrogen sulfide
   - Ethylene
   - Visibility reducing particulates

3. Other air quality considerations
   - Ozone depletion
   - Odor

B. Surface and Ground Water Quality and Quantity

1. Effect on beneficial uses
   - Municipal and domestic supply
   - Agricultural supply
   - Industrial process supply
   - Industrial service supply
   - Goundwater recharge

- Freshwater replenishment
- Navigation
- Hydropower generation
- Water contact recreation
- Non-contact water recreation
- Ocean commercial and sport fishing
- Warm freshwater habitat
- Cold freshwater habitat
- Preservation of areas of special biological significance
- Saline water habitat
- Wildlife habitat
- Preservation of rare and endangered species
- Marine habitat
- Fish migration
- Fish spawning
- Shellfish harvesting

2. Water quality objectives have been set forth in the Basin Plan (Water Quality Control Plan, San Francisco Bay Basin) to protect the beneficial uses of surface and ground waters. These objectives have been accepted by State and Federal agencies. The assessment process will involve the estimation of the effects of alternative environmental management strategies with respect to these water quality objectives and other policies.

3. The assessment process will also involve the estimation of mass emission rates of pollutants. These emissions will include:

   - Organic material
   - Nutrients
   - Sediments and other suspended solids
   - Disease causing organisms

- Floating material
- Heat
- Radioactivity
- Heavy metals and other toxicants
- Chemical constituants

4. Effect on surface and ground water quantity

   - Impact on surface water supplies and requirements for water importation
   - Impact on groundwater table
     - Changes in safe yield
     - Subsidence

C. Physical Resources

1. Effect on flora and fauna

   - Impacts on desirable, unusual, rare, or endangered species
   - Impact on plant species which provide cover and food for important wildlife species
   - Effects upon noxious species of plants or animals

2. Effect on the supply of critical land-related resources

   - Impact on prime or unique agricultural lands
   - Impact on other agricultural lands
   - Impact on mines, quarries, and mineral-bearing lands.
   - Impact on timber-producing and other forested lands
   - Impact on salt ponds
   - Impact on geothermal sites
   - Impact on wet lands, marshes, coastal zones, and estuaries
   - Impact on wildlife habitat
   - Impact on hilly land, fragile land, or land subject to erosion

3. Effect on land sites with special development characteristics

   - Effects upon lands uniquely suited for seaport, airport, marina, or energy site development

4. Effect on recreation use or potential

   - Impact on actual or potential recreation sites (e.g., parks, beaches, stadia, etc.)

   - Impact on recreation use

5. Effect on solid waste

   - Impact on solid waste volume

   - Impact on resource recovery

   - Impact on hazardous materials

D. Energy

1. Effect on energy consumption/demand

   - Impact on natural gas consumption

   - Impact on electricity consumption

   - Impact on petroleum consumption

   - Impact on coal or other non-renewable energy resource consumption

2. Effect on energy conservation/supply

   - Impact on efficiency in the use of energy

   - Impact on energy use

     - Peak energy use

     - Off-peak energy use

   - Impact on resource recovery and recycling

   - Impact on energy production as a by-product of residuals management

   - Impact on solar energy production

E. Amenities

1. Effect on visual amenities

- Preservation of scenic areas, the natural state of the environment, and open space.
- Height and bulk of structures required for or affected by the plan
- Visibility impact of clean air
- Appearance of urban landscape

2. Effect on historic and cultural resources

- Impact on historic landmarks, monuments, districts, archaeological sites, and other areas of historic or cultural significance
- Impact on sites with special water-related historical significance

3. Effect on noise

- Impact and location of transportation noise
- Impact and location of construction noise
- Special noise problems due to pollution reduction activity (e.g., trash collection, street sweeping)

4. Effect on odor

- Impact on type, strength, location and duration of odors

II. INSTITUTIONAL AND FINANCIAL CRITERIA

A. Financial

1. Direct costs of implementation

- Capital and replacement costs
- Operating/maintenance costs
- Administrative costs
- Costs of regulation, inspection, and enforcement

2. Fiscal effects on local government (assuming constant levels of State or Federal assistance)

   - Impact on general obligations, revenue or special assessment bonds and bonding capacity
   - Impact on property tax base
   - Impact on property tax rate
   - Impact on sales and other taxes
   - Impact on fees, licenses, and other user charges
   - Impact on connection and stand-by charges
   - Imapct on Federal and State grant subvention funding dependence and eligibility
   - Impact on interest earnings and cash revenues

B. Institutional

1. Impact on the provision of public services
   - Type, level, and displacement of public service (e.g., police, fire, sewerage, etc.)

2. Effect on public agencies
   - Impact on intergovernmental responsibility and coordination

3. Implementability
   - Public acceptability
   - Organizational and political feasibility
   - Legal capability
   - Impact on existing plans, regulations, and policies
   - Complexity or simplicity of control measures and their implementation

4. Flexibility
   - Reversability of decision

III. ECONOMIC CRITERIA

A. Production of goods and services

1. Effect on industrial, commercial, agricultural, and service activity by categories (e.g., manufacturing, construction, transportation, etc.)

2. Effect on employment, unemployment, and underemployment

   - Impact on job creation and elimination by categories (e.g., professional, technical, crafts, etc.)

B. Income and investment

1. Effect on wages and salaries

2. Effect on rents

3. Effect on capital investment for new and replacement facilities or equipment

4. Effect on profits

C. Consumer expenditures

1. Effect on the prices of goods and services

2. Effect on consumption of goods and services

IV. SOCIAL CRITERIA

A. Housing Supply

1. Effect on existing housing stock

   - Impact on the removal of housing by demolition or conversion
   - Impact on housing quality
   - Impact on the cost of housing and rent
   - Impact on the cost of housing rehabilitation & maintenance

2. Effect on new housing stock

- Impact on the cost of new housing
  - Cost of land
  - Cost of site preparation
  - Cost of construction
- Impact on supply of new housing
  - Quantity of new units produced
  - Proximity to employment opportunities

B. Physical Mobility

1. Impact on public transportation
   - Cost
   - Time
   - Convenience
   - Purpose of trip

2. Impact on private transportation
   - Cost
   - Time
   - Convenience
   - Purpose of trip

C. Health and Safety

1. Effect on site hazards
   - Impact on seismic safety and risk
   - Impact on flood plain safety and flood risk

2. Effect on transportation conflicts

3. Effect on public health

D. Sense of Community

1. Effect on community character

2. Effect on community stability

E. Equity

1. Impact on individual opportunity and lifestyle

2. Impact on special population groups

   - Aged
   - Youth
   - Ethnic Minorities
   - Women
   - Low-income
   - Handicapped people
   - Individuals with special employment problems

F. Urban Patterns

1. Location of development

2. Density of development

3. Type of development

4. Timing of development

GLOSSARY

GLOSSARY

ABAG:	The Association of Bay Area Governments.
Best Management Practices:	Those specific measures and practices among all possible alternatives that best address a specific problem in a specific area. Generally good urban "housekeeping".
BOD:	Biochemical Oxygen Demand. A measure of the quantity of dissolved oxygen used in the decomposition of organic matter by microorganisms such as bacteria.
Calibration:	The adjustment of the mathematical empirical relationships in a model to ensure accurate replication of the modeled process.
Catch Basin:	A chamber or well, usually built at the curb line of a street, for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.
Coliforms:	A large and varied group of bacteria. Fecal coliform bacteria, commonly found in the intestines and feces of warm blooded animals (including man), apparently does not cause disease, but its presence in water suggests that disease causing organisms may be present. Coliforms are used as indicators of pollution because they are abundant and their presence is fairly easy to detect.
Composite Sample:	A single sample made up of water collected at a single site at specific time intervals and mixed together to produce an "average" sample.
Computer Modeling:	The simulation of certain physical events via a mathematical model. As the calculations involved are usually numerous and lengthy, a computer is used to expedite the process.
Concentration:	The quantity of a given constituent in a unit volume or weight of water.
Control Measure:	Any action that will reduce or hold steady the quantity of one or more pollutants being discharged into a receiving body of water.
EMP:	The Environmental Management Plan for the San Francisco Bay Area.
EPA:	The Environmental Protection Agency.
Erosion:	The washing away of soil by the action of surface runoff.

Eutrophication: The progressive enrichment of surface waters particularly non-flowing bodies of water such as lakes and ponds with dissolved nutrients, such as phosphorous and nitrogen compounds, which accelerate the growth of algae and higher forms of plant life and result in the utilization of the useable oxygen content of the waters at the expense of other aquatic life forms.

Fecal Coliform: Fecal coliform are indicators of human and animal pollution and are expressed as number of bacteria per volume of sample.

Grab Sample: A single sample taken at a single site by simply emersing the sample container. See Intensive Sampling and Spot Check Sampling.

Heavy Metals: Elements in water that can be precipitated by hydrogen sulfide in acid solution, e.g., lead, silver, mercury and copper. Considered as serious pollutants.

Implementation: Actually putting a control measure <u>into effect</u> as opposed to <u>preparing</u> a control measure to be put into effect. (See Preparatory Work)

Input: The data required by a computer model to make a run.

Intensive Sampling: A sampling procedure whereby complete sample sets are collected every 15 minutes or so at a single site throughout a single storm. Such a procedure provides data on the variations in pollutant concentrations over the duration of a storm.

Land Use Category: The specific classification of a given piece of land based on its predominant use, e.g., residential, commercial, etc.

Lead Agency: The specific public agency in each county responsible for the preparation of the SRMP. In Marin County, the Comprehensive Planning Department.

Loading: The quantity of a specific water quality parameter discharged into a specific body of water over a specific period of time.

MAC: Abbreviation for the Macroscopic Planning Model. A computer model used in the preparation of the Surface Runoff Management Plan.

Management Plan: A specific work program to control and/or reduce specific types of pollution.

Mass Emission Rate: The pollutant loading of a specific water course expressed in terms of pounds of pollutant per second or minute.

M.B.A.S.: Methylene Blue Active Substances. Detergents.

Model Run: The process of having the computer perform the model calculations with a specific set of input data.

Monitoring: The measurement of water quality.

Non-Point Source: Wasteloads which do not enter receiving waters at a commonly identifiable location, e.g., surface runoff, aerial fallout, vessel wastes.

Nutrients: Those elements which provide food for aquatic plant life. Generally nitrogen and phosphorus.

Outfall: The point or location where waste water or drainage discharges from a sewer, drain or other conduit.

Output: The data calculated by a computer model. The results of a model run.

Point Source: Wasteloads which enter receiving waters at a commonly identifiable location, e.g., municipal sewage treatment plant or industrial discharges.

Pollutant: Refers to any of several constituants found in water and deemed to be harmful if present in large enough quantities. Referring to something as a pollutant generally refers to its potential and does not necessarily imply an existing problem. (See Pollution and Water Quality Parameter)

Pollution: The loss or impairment of a beneficial use of a body of water due to a change in the level of one or more water quality parameters.

Preparatory Work: The preliminary work necessary for the implementation of a specific control measure, e.g., hearings, ordinance drafting, bond elections, etc.

Public Law 92-500: The federal law which required the preparation of the EMP. Also known as the Federal Water Pollution Control Act Amendments of 1972.

Quality Coefficient: An "average" or "reasonable" figure for the concentration of a specific water quality parameter in the runoff from an area of a specific land use catagory. Used in the computer models. See Appendix D.

Runoff Factor: The percentage of rainfall that actually runs off the land and into a drainage system.

Sample Set: A group of water samples to be analyzed for several water quality parameters. (See Analysis)

Sampling: The physical process of obtaining Sample Sets.

Sediment: Visible fine organic or earthen particles suspended in water.

Sedimentation: The process of subsidence and deposition of suspended matter carried by water, sewage, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point where it can transport the suspended material.

Silt: Fine particles of soil and rock usually less than 1/20 millimeter in diameter.

Spot Check Sampling: A sampling procedure whereby a single sample set is collected during a single storm at a single site. As opposed to intensive sampling, a spot check only provides data on the concentrations of pollutants for a single point in time.

SRMP: The Surface Runoff Management Plan.

Subarea: A small waterhshed or other specific area contained within a larger watershed.

Suspended Solids: Particulate matter held in suspension (as opposed to dissolved) in water and readily removable by filtering.

Surface Runoff: Rainwater which flows over the land surface and into a drainage system rather than soaking into the ground or evaporating.

SWMM: The Stormwater Management Model.

Water Quality Parameter: A general term referring to any one of the many properties or constituants of a body of water that are commonly measured as indicators of the quality of the water, e.g., temperature, dissolved oxygen, BOD, suspended solids.

Watershed: A region or area bounded peripherally by a drainage divide and draining ultimately to a particular watercourse or body of water.

Water Year: Generally October 1 of one year to September 30 of the next year. Can also mean simply the rainy season.

NAPA COUNTY
SURFACE RUNOFF MANAGEMENT PLAN
OCTOBER 12, 1977

208

AN ELEMENT OF THE

SAN FRANCISCO BAY AREA

ENVIRONMENTAL MANAGEMENT PROGRAM

PREPARED

BY

NAPA COUNTY DEPARTMENT OF PUBLIC WORKS

1127 FIRST STREET NAPA, CALIFORNIA

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CONTENTS

APPENDICES

F I G U R E S

TABLES

DEFINITIONS

ABAG - Association of Bay Area Governments.

Ammonia Nitrogen (NH_4 - A form of nitrogen which is an essential nutrient to plants (can cause algal blooms if all nutrients are present in sufficient quantities). A product of natural decomposition of fecal matter, urea and other animal protein.

Biochemical Oxygen Demand (BOD) - A measure of the consumption of dissolved oxygen in water by the oxidation of organic materials. In general terms, a high BOD suggests a water burdened with organic wastes and thus likely to be deficient in oxygen and inhospitable for most plant and animal life. BOD values in this report are based on the standard 5 day test which technically is written BOD_5.

Boron - A minor constituent of most natural waters. Values greater than 1.0 mg/l are classified as doubtful for use on boron sensitive crops. Boron accumulation in irrigated soil is potentially harmful to grapevines.

Cadmium (Cd) - An element of high toxic potential when taken by mouth and possible association with renal arterial hypertension at sublethal levels.

Chemical Oxygen Demand (COD) - A determination of organic material. The sample is "completely" oxidized by chemical methods, instead of the incomplete oxidation by bacteria in the BOD_5 test.

Chromium (Cr) - A toxic element when present in the hexavalent chromium ion form.

Coliforms - A large and varied group of bacteria. Fecal coliform bacteria, commonly found in the intestines and feces of warm blooded animals (including man), apparently does not cause disease, but its presence in water suggests that disease causing organisms may be present. Coliforms are used as indicators of pollution because they are abundant and their presence is fairly easy to detect.

Copper (Cu) - An essential and beneficial element in human metabolism, but quantities above 1 mg/l tend to impart an undesirable taste to drinking water.

Cubic Feet Per Second (cfs) - One cubic foot volume of water passing a point per unit second.

Dissolved Oxygen (DO) - The concentration of oxygen dissolved in water (measured in mg/l). Non-living organic matter and various chemicals react with oxygen in water, depleting its concentration and causing stress (from lack of oxygen) on fish and other aquatic life. DO saturation levels are greater in cold water than in warm, and at sea level (high atmospheric pressure) than at high altitudes (low atmospheric pressure).

Effluent - The treated liquid discharged by a municipal sewage treatment plant, industrial treatment plant, or septic tank system.

EPA - Environmental Protection Agency.

Fecal Coliforms - Indicators of recent fecal pollution in water by pathogenic bacteria. See coliforms.

Heavy Metals - Metals that can be precipitated by hydrogen sulfide in acid solution. For example, lead, silver, gold, mercury, and copper.

Iron (Fe) - An element that imparts a bitter taste to water and a brownish color to clothing laundered in such water.

Lead (Pb) - A highly toxic heavy metal when ingested for either brief or prolonged periods (cumulative poison).

Low Flow - The period, during the course of a year, when the flow in a stream is at a minimum. In California, low flow usually occurs in late summer or early fall, at the end of the dry season.

Mercury (Hg) - A heavy metal which can cause severe neurological disorders when it is ingested in large quantities. (Particularly dangerous because small quantities can be concentrated by aquatic organisms which are frequently eaten by man).

Milligrams Per Liter (mg/l) - The milligrams of a substance per liter of water on a dry weight basis.

Most Probable Number (MPN) - A statistical indication of the number of bacteria present in a given volume (usually 100 ml).

Nitrate (NO_3) - A form of nitrogen which is an essential nutrient to plants (can cause algal blooms if all other nutrients are present in sufficient quantities). Product of bacteria oxidation of other forms of nitrogen, from the atmosphere during electrical storms and from fertilizer manufacturing.

Nonpoint Source (water pollution) - A term used to describe the contribution of water pollutants from sources that do not emanate from pipes or other man-made conduits. Examples of non-point sources are runoff from agricultural land and runoff from urbanized land.

Nutrients - Substances or ingredients essential to biological growth.

pH - An indication of the acidic or alkaline characteristic of water. On a scale of 1 to 14 one is extremely acidic, seven is neutral and fourteen is extremely alkaline.

Point Source - A discrete place or object (such as as outfall from a sewage treatment plant) from which relatively large quantities of water pollutants are emitted.

Pollutant loading - An estimation of the amount of a given pollutant washing off a land surface of a given type, usually after a rail-fall.

RWQCB - Regional Water Quality Control Board. (San Francisco regional office).

Runoff and Receiving Water - A natural watercourse, lake or ocean into which surface treated or untreated wastewater is discharged.

Suspended Solids (SS) - See Total Suspended Solids.

Total Coliforms - See Coliforms.

Total Dissolved Solids (TDS) - Salts in solution. A measure of the mineralization of the water.

Total Nitrogen (TN) - The total amount of the element nitrogen, a principal nutrient required for biological growth, in all its chemical forms. Four forms of nitrogen are of main interest in water quality management. These are ammonia, nitrite, nitrate, and various compounds of organically-bound nitrogen. These forms are all normalized and expressed as total nitrogen.

Total Phosphorus (TP) - The total amount of the element phosphorus, a principal nutrient required for biological growth, in all its chemical forms. Phosphorus may exist in wastewater as ortho, poly, and organic phosphorus. It is a good indicator of the potential biological productivity of the water.

Total Suspended Solids (TSS) - All particulate matter in a water sample that is removable by laboratory filtering. Consists of inorganic and organic matter.

"201" - Refers to Section 201 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). Section 201 calls for detailed planning for the wastewater treatment facilities needed to achieve the goals of the Act.

"208" - Refers to Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). Section 208 provides for the designation of areawide waste treatment management planning agencies for the purpose of "developing effective areawide waste treatment management plans" for areas that, because of "urban-industrial concentrations" or other factors, have "substantial water quality control problems." The areawide approach is aimed at integrating controls over municipal and industrial wastewater, storm sewer runoff, non-point source pollutants and land use.

Volatile Suspended Solids (VSS) - The organic constituent of suspended solids.

Zinc (Zn) - An essential element in human health which, when present in excess, can impart a milky appearance and metallic taste to water supplies. Is toxic in large quantities to many organisms.

1. SUMMARY

This Surface Runoff Management Plan for Napa County will be integrated with runoff plans of the other bay area counties into a regional plan which in turn will be one of seven elements of the overall Environmental Management Plan. The elements address air quality, solid waste, water conservation, water quality from nonpoint sources (surface runoff) and from point sources.

In the realm of water quality, pollution caused by surface runoff is becoming a major item of concern. Past efforts to reduce pollution have focused upon discharges by factories and municipal sewage treatment plants. As these industrial and municipal sources are brought under control it becomes increasingly apparent that surface runoff as a source of pollution becomes more significant.

"When a city (or rural area) washes where does the wash water go?" As surface runoff flows from parking lots, vineyards, driveways, construction cites, agricultural areas and streets it tends to flush leaves, eroded soil, litter, heavy metals from automobile exhaust, and other minute particles into the storm drains, streams and the river. These materials flowing into the receiving waters can be significantly responsible for observed water quality problems.

This plan identifies seven water quality problems in Napa County:

1. Evidence of septic tank effluent in Edgerly Island drainage ditches.

2. Evidence of septic tank effluent in a drainage swale near the Auction Yard/Tower Road area.

3. High coliform counts in Conn Creek at Lake Hennessey.

4. Boron values in upper Napa River sometimes exceed irrigation standards.

5. Algae bloom and depressed dissolved oxygen values in the lower Napa River.

6. Algae growth plus stratification in fresh water reservoirs.

7. Degraded water quality in streams, drainage channels and Napa River due to illegal dumping of refuse.

Regarding the evidence of septic tank effluent in Edgerly Island drainage ditches it is important to note that the County's Division of Environmental Health is presently investigating alternative collection and treatment facilities in the anticipation of applying for a federal 201 grant to construct such facility.

Regarding the evidence of septic tank effluent in a drainage swale near the Auction Yard/Tower Road area it should be noted that the problem has been corrected. However, the problem is listed because it typifies other areas which have undergone development and exhibit problems from time to time and therefor require surveillance and corrective action.

The remaining problems are different. Generally their sources are not pinpointed.

They are difficult to quantify. In some cases the cause of the problem is not well understood. This makes even more uncertain what type of control measure should be developed and to what extent the measure should be applied. Algae blooms and depressed dissolved oxygen in the lower Napa River is an example. How serious a problem is it? How much is caused by suspended solids washed from the land surfaces? Consequently remedial action for this problem should begin with acquiring additional data through ongoing water quality monitoring by the Napa Sanitation District and the Napa County Flood Control and Water Conservation District. Remedial action also should include voluntary measures by landowners and public agencies to alter their operations so as to reduce the amount of suspended solids being washed into storm drains and natural water courses.

The overall approach to the solution of water quality problems should be undertaken in graduated steps. Local agency guidelines proposed by this Plan include the following:

1. Maintain and utilize the present level of effort in funding and manpower for diverse activities such as storm drain cleanup, street sweeping, erosion control through administration of building and grading permits and the encouragement of good soil management practices.

2. Undertake as soon as possible the control of problems which are presently supported by adequate documentation and quantification.

3. Monitor, document and quantify problems sufficiently to support whatever additional controls are needed.

4. Transmit data to staff of local agencies for their information and application in their operations such as land use planning, permit processing and construction or maintenance operations.

5. Local agencies establish standards necessary to achieve control.

6a. Local agencies fund and administer the application of standards for agency operations such as revised street sweeping or improved erosion control during routine maintenance.

6b. Local agencies fund and administer the application of standards through the regulatory process dealing with such activities as land use or grading permits.

7. If the foregoing steps are inadequate to improve the qaulity of the receiving waters then local agencies may need to pass additional ordinances which mandate actions that heretofor had been voluntary such as parking controls in residential and industrial areas in order to permit improved street sweeping. Also local agencies may need to create and fund institutions such as a septic tank maintenance district in order to assure proper operation of septic tank systems.

This Plan is divided into two phases. Phase I, November 1977 to June 1979, generally includes additional data gathering and voluntary, low cost actions. Phase II, July 1979 to June 1983, includes intensified actions to determine magnitude of problem and the development and implementation of control measures.

2. INTRODUCTION

A. WHY BE CONCERNED WITH SURFACE RUNOFF?

Surface runoff deals with water that surface flows from rooftops, driveways, sidewalks, parking lots, streets and other paved surfaces. It deals with water that surface flows from construction sites, lawns, golf courses, parks, vineyards, feedlots, pastures and undeveloped open spaces.

Its sources include rainfall, spray cleaning operations by manufacturers, businessmen and householders and agricultural spray irrigation.

As the water flows from the above surfaces it tends to carry whatever is flushed from the surface. This includes oil drippings, chewing gum wrappers, lawn and yard clippings, leaves, silt, animal droppings, cigarette butts and milk shake containers. These are the visible parts. Smaller or invisible particles include pesticides, chemical and natural fertilizers, rubber tire particles, eroded soil, minute organic particles from dead plants, heavy metals from engine exhaust and more eroded soil. As these innocent materials are washed into creeks, gutters and storm drains they give the surface runoff an insidious characteristic. The water may now be carrying significant amounts of natural and man-made debris, eroded soil, organic nutrients and bacteria.

"When a city washes where does the wash water go?" The phase should apply to rural, undeveloped areas as well. The "washwater" goes into the streams, the river, water supply reservoirs and the Bay.

This form of pollution has received little attention until recent years. Past water quality efforts have focused upon reducing pollution caused by discharge from factories and municipal sewage treatment plants. As these industrial and municipal sources are brought under control it becomes apparent that surface runoff as a source of pollution becomes more significant.

This Surface Runoff Management Plan attempts to respond to the problem without "throwing the baby away with the wash water".

B. LEGISLATIVE MANDATE

The mandate to prepare an Environmental Management Plan (EMP) for the Bay Area is derived from three sources: federal water and air quality legislation, federal and state policies developed under this legislation and federal and state solid waste planning legislation. Foremost are the federal Water Pollution Control Act Amendments of 1972 and the federal Clear Air Act of 1970.

Similar environmental management planning is underway in more than one hundred areas across the nation.

In Napa County the Napa River watershed and Suisun Creek watershed (Wooden Valley) are included in the Bay Area plan. Water quality planning for the Putah Creek watershed is under the jurisdiction of the State Water Resources Control Board.

C. ENVIRONMENTAL MANAGEMENT PLAN

The Water Pollution Control Act Amendments of 1972 (Public Law 92-500) established procedures for water quality control through designated planning areas. The law is administered by the Environmental Protection Agency (EPA). The law permits the Governor to designate the agency responsible for developing the water quality control plan.

On the recommendation of the California Water Resources Control Board the Governor designated the Association of Bay Area Governments (ABAG) as the agency responsible for the San Francisco Bay Area. Water quality is only one of several planning concerns to be addressed. The overall Environmental Management Plan will consist of seven major management plans:

- Surface Runoff
- Air Quality Maintenance
- Municipal Wastewater Facilities
- Other Nonpoint Sources
- Industrial Discharges
- Water Conservation, Reuse and Supply
- Solid Waste (Including municipal wastes, hazardous wastes and wastewater residuals).

The EMP for the Bay Area is unique among those underway across the nation because it combines plans related to air, water and solid waste.

ABAG development of the EMP is directed by the Environmental Management Task Force, a policy making body consisting of representatives from local governments, regional agencies, citizen groups and special interest groups. Napa County members and their representation are: Supervisor John Tuteur (County); Councilperson Dorothy Searcy (Napa County Cities); and Supervisor Sam Chapman (Bay Area Air Pollution Control District).

By October 12, 1977 the County will formally transmit its Surface Runoff Management Plan to ABAG where it will be integrated into the EMP.

In early December ABAG will release the draft EMP for review and comment by the counties and other local governments. The EMP together with comments by the local governments will then be considered by the Environmental Management Task Force. In April, 1978, the EMP will be voted upon by the ABAG General Assembly for transmittal to State agencies and the EPA. A proposed EMP Development and approval schedule is shown in Appendix D.

Local public participation in the development of the EMP has been and will be available through the "Round Tables" conducted by ABAG.

D. LOCAL DEVELOPMENT OF THE SURFACE RUNOFF MANAGEMENT PLAN

Six of the seven major plans constituting the EMP are being developed by ABAG staff and its consultant specialists. The seventh, surface runoff, is being developed at county level by the individual counties. Napa County acting through its Board of Supervisors is the lead agency. The County Department of Public Works is the lead department.

The department's preparation of the surface runoff plan is made with the assistance and counsel of the Citizen's Advisory Committee, Surface Runoff Management Plan.

3. GOALS AND OBJECTIVES

A. NATIONAL OBJECTIVE

A portion of the Federal Water Pollution Control Act Amendments of 1972 states as follows:

> The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. In order to achieve this objective it is hereby declared that, consistent with the provisions of this Act--
> 1) it is the national goal that the discharge of pollutants into the navigable water be eliminated by 1985;
> 2) it is the national goal that wherever attainable, an iterim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;
> 3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;

THE KEY GOAL IS THAT SWIMMABLE AND FISHABLE WATERS BE ACHIEVED WHEREVER POSSIBLE BY 1983. (EMP Work Program, ABAG)

B. NAPA COUNTY GOALS

The water quality in the Napa River, the streams and the lakes of the County be improved to the maximum feasible extent by management actions that are socially, economically, politically and environmentally balanced and acceptable to the people of Napa County.

The Surface Runoff Management Plan be managed to comply as fully as possible with the requirements of Section 208 of the Federal Water Pollution Control Act of 1972 in a manner consistent with the economic resources and environmental constraints of the County.

The Surface Runoff Plan be managed in a manner that is environmentally and economically in balance with the overall Environmental Management Plan.

C. NAPA COUNTY OBJECTIVES

1. Maintain 1977-78 levels of practices which are beneficial to water quality.
2. Develop data gathering and water quality monitoring programs in order to define and quantify problems and in order to support more expensive control measures where necessary.

3. Develop control measures that can be easily revised if the effectiveness or social acceptance of the measure is not supported.

4. Provide maximum opportunity for the general public and local public agencies to participate in decisions regarding the management and implementation of the Surface Runoff Management Plan.

4. ENVIRONMENTAL SETTING

A. LOCATION

The Napa Valley, encompassing all those areas tributary to the Napa River, plus the Wooden Valley area tributary to Suisun Creek, comprises the Study Area. This excludes that portion of Napa County which is in the watershed area of Putah Creek whose water flows finally to the Sacramento River, Figure 4-1 shows the location of the Study Area.

Of Napa County's 790 square miles, 376 square miles are in the Napa River drainage basin and 50 square miles are in the Wooden Valley area tributary to Suisun Creek. Nearly all of the existing and anticipated urban developments within the County are located in the Napa River drainage basin. The majority of the County's intensive agriculture operations is located in the Study Area.

B. POPULATION

Population in Napa County is centered mainly in the urban areas. The 1975 County-wide special census indicates a total of 90,697. The incorporated cities have the following populations: Napa, 46,867; Yountville, 2,789; St. Helena, 3,808; and Calistoga, 2,832 all totaling 56,296 or 62.1 percent of the county population. Unincorporated communities of American Canyon and Angwin have populations of 5,945 and 3,035, respectively. The remaining unincorporated population is located on the periphery of the incorporated cities or is scattered throughout the rural areas of the County and in smaller communities such as Rutherford, Oakville, Edgerly Island and the resorts at Lake Berryessa.

Population in the rural areas with the exception of Lake Berryessa resorts and Edgerly Island consists principally of ranchers, farmers and their employees plus owners of scattered estate homes who commute elsewhere to work.

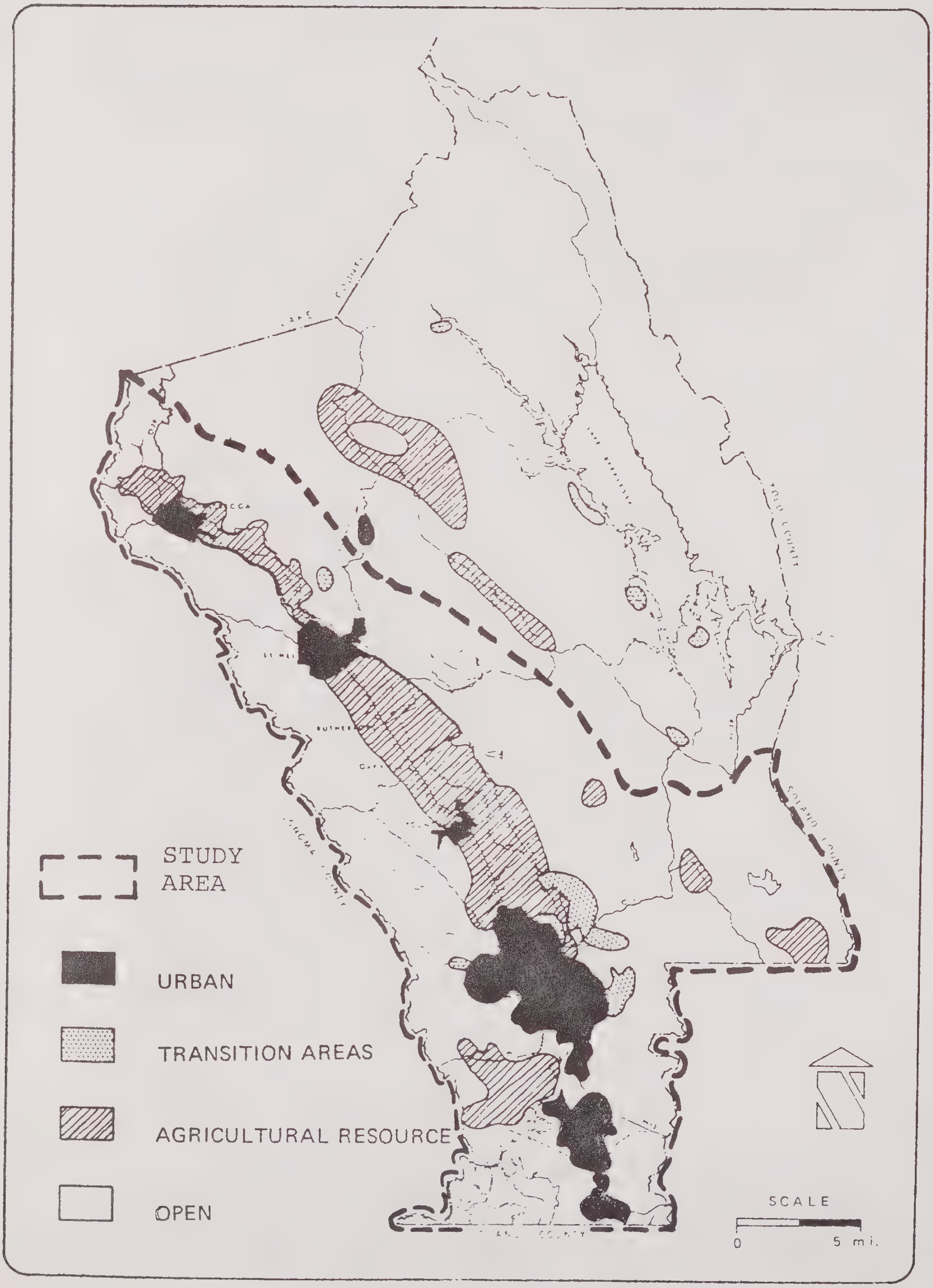
The total unincorporated population including the Berryessa watershed, which is out of the study area, is 34,401, 37.9 percent of the population.

C. GEOLOGY

The Napa Valley, one of three northwesterly trending valleys opening off the north San Pablo Bay, is a structural trough known as the Napa Valley Syncline. The Syncline was formed during Pliocene time by downwarping and faulting of the older rocks now underlying the valley floor. These

FIGURE 4-1

STUDY AREA



(Based upon Land Use Concept Map, Land Use Element, Napa County General Plan)

older deeper rocks lying beneath the valley, surfacing in the mountains forming the valley sides, consist of Franciscan, Knoxville and Horsetown sediments of Jurassic and Cretaceous age and Sonoma Volcanics of the Pliocene age. These rocks, extensively folded and faulted, form the shallow structural trough into which were deposited the unconsolidated sediments of the Pleistocene age, plus the older and younger alluvium of late Pleistocene and recent ages.

The alluvial materials found throughout the region include older alluvium, terrace deposits older alluvial-fan deposits and younger alluvium. The major alluvial deposit, older alluvium, may reach thicknesses of up to 500 feet. It is composed of interbedded and lenticular deposits of unconsolidated gravel, sand, silt, and clay. Some lenses of these materials may be only 10 feet thick but extend laterally over large areas. These deposits characteristically feather out and disappear at the edges of the valley. (Environmental Assessment and Resource Planning, 1974)

Underlying the floodplains of the Napa River and its tributaries is the younger alluvium. This material covers all older materials and consists of interbedded gravel, sand, clay, and peat, a large amount of which is loose and unconsolidated. Characteristically, the younger alluvium is found throughout the Napa Valley, but seldom exceeds 30 feet in depth. (Environmental Assessment and Resource Planning, 1974)

D. SOILS

Generalized soil classifications and soil limitations for agricultural production for Napa County have been mapped by the Soil Conservation Service. Soil interpretations presented in Table 4-1 are generalized and additional onsite investigation of specific soil qualities is necessary for specific projects.

TABLE 4-1

GENERALIZED SOIL CLASSIFICATIONS

Planning Area	Predominant Soil Types	Agricultural Class
1. Napa Valley (valley floor)	Bale association, Yolo association, Pajaro association	2
Napa Valley (hillsides)	Red Hill-Butte association, Kidd-Jiggs-Cohasset association, Maymen-Los Gatos association	6,7,8
2. Greater Napa City	Pajaro association, San Ysidro-Coombs association, Millsap association	2,3,4
3. Carneros	Reyes association, San Ysidro-Coombs association, Altamont-Diablo association	3,4
4. American Canyon	Reyes association, San Ysidro-Coombs association, Clear Lake association, Dibble-Los Osos association	3,4,6
5. Suisun Watershed	Toomes-Kidd association, Dibble-Los Osos association	6,7

E. CLIMATE

The regional climate affecting the Napa County area is governed by the geographic position of the Central Valley of California, the County's position in the Interior Coast Range, and its proximity to warm water circulation from the Japanese Currents that affect the California coastline. The rain season begins on or shortly after the autumnal equinox; and under usual atmospheric conditions, ends about the time of the vernal equinox.

Following the vernal equinox, precipitation rapidly declines; and usually, from the period of June through August the probability of rain in Napa County is extremely low. This summer drought period is accompanied by temperatures with daily maximums ranging between 75^{o}F and 105^{o}F.

The cyclic weather system precipitates about 33 inches of rainfall annually, ranging from 17 inches in the American Canyon area to 30-40 inches

on the higher peaks around the Napa Valley to over 50 inches atop Mt. St. Helena. Average January temperatures are 56° F maximum and 36° F minimum and July temperatures are 88° F maximum and 52° F minimum.

The intense ground heating in the summer that is typical of much of the interior coast range is ameliorated in mid-afternoon by the cool ocean breezes that sweep up the Napa Valley from the Carquinez Strait and, to a lesser extent, blow directly over the mountains from the sea. These breezes are a result of cool ocean air flowing inland to fill the void left by hot rising air in the Sacramento-San Joaquin Valley.

F. HYDROLOGY

Within the study area there are two major watersheds: the Napa River watershed, comprising approximately the west half of the County; and the watershed of Suisuin Creek which drains southeastern Napa County.

The major water supply watersheds are those above Kimball Dam, Bell Canyon Reservoir, Lake Hennessey, York Diversion Dam, Milliken Dam, Lake Curry, and Lake Madigan.

The Napa River watershed, encompassing approximately 376 square miles, drains into San Pablo Bay. Precipitation in Napa County is highly seasonal with almost 90% of the annual precipitation occuring during the six-month period November through April. Storm runoff comprises approximately 40 percent of the total annual flow from the above named watersheds. (Estimate by the Napa County Flood Control and Water Conservation District, 1975)

The maximum recorded flow for the Napa River near Napa station was 16,900 cubic feet per second (cfs) in January , 1963. It is estimated, however, that this discharge was exceeded in 1970, 1940, 1942 and 1955.

G. WATER QUALITY

Data collected by the Napa Sanitation District as part of a study of water quality conditions in the Napa River indicate significant changes in the quality of the river water (Oswald, 1964, 1972). In 1964, the estuary was characterized as "...essentially acting as a heavily loaded facultative stabilization pond with large diurnal variations in dissolved oxygen." (Oswald, 1964), primarily as a result of discharge of poorly treated sewage by the Napa Sanitation District. Following construction by the District of secondary treatment facilities, water quality in the Napa River estuary improved to the point that in 1972 it was characterized as "... an estuary showing normalcy in all aspects with a rapidly recovering biotic population and water quality sufficient to sustain continued improvement in the quality of the aquatic biota." (Oswald, 1972)

The quality of the groundwater in the Napa Valley is generally good with some notable exceptions. High sodium chloride concentrations are found in the Calistoga area, west of St. Helena and in the vicinity of Oakville. These waters are associated with hydrothermally active areas and are of volcanic origin. The primary groundwater supplies are classified as either calcium-magnesium bicarbonate or magnesium-bicarbonate water. The former type is found throughout the Napa Valley, and is obtained mainly from alluvial materials and, in some areas, from the Sonoma Volcanics. This water is of excellent quality and is utilized for both domestic and irrigation purposes. (Environmental Assessment and Resource Planning, 1974)

Domestic water for the City of Napa is supplied by three primary sources: Lake Hennessey, Milliken Reservoir, and the North Bay Aqueduct. Full treatment facilities treat water from Milliken Reservoir and the North Bay Aqueduct.

The American Canyon Community is served by water from the North Bay Aqueduct and from the City of Napa. The City of Calistoga is supplied from a municipal reservoir and wells. St. Helena is supplied from a municipal reservoir while Yountville and the Veterans Home are served by Rector Reservoir. The Angwin area is served by a private water company, small domestic water systems, and domestic wells. Outlying unincorporated areas are served by wells and springs. (Napa County Flood Control and Water Conservation District, 1975)

A typical weakness of statements describing general conditions is that obvious exceptions do exist. Regarding water quality, certain specific areas are experiencing water quality and quantity problems. Two examples are the Lower Milliken - Sarco - Tulucay Creeks area and the Los Carnernos area. The U.S. Geological Survey has prepared a report on the former.

5. PAST INVESTIGATIONS

Past studies appear to reflect the concern for maintaining acceptable water quality in the Napa River. Shipyard activities at Mare Island, effluent discharge from sewage treatment plants, agricultural practices in animal and plant husbandry, plus urban surface runoff, all have contributed their share to the pollution impact occuring naturally due to runoff from hillsides, woodlands and other undeveloped areas. A summary of applicable past studies is shown in Appendix A.

Past investigations also include water quality monitoring at various sites on the Napa River and its tributaries. Applicable past monitoring is included with the data summary in Appendix B. Certain data are not summarized, such as one season sampling by the California Department of Transportation for standard minerals and miscellaneous nutrients at Highway 121 and the Napa River. Also older data are not listed.

Appendix B summarizes data related to past programs, some of which are still on-going. The Napa River Baseline Water Quality Study is further discussed under Present Investigations.

6. PRESENT INVESTIGATION

This chapter includes a description of the investigations utilized for this surface runoff study. Further, this chapter includes pertinent results of such investigations, then a discussion of water quality as evidenced by certain water quality parameters.

Conclusions are presented in Chapter 10.

A. MATHEMATICAL MODEL (MAC) RESULTS

Table 6-1 summarizes the mathematical modeling results for Napa County.

Before discussing the summary, it should be noted that there are several important inputs to the modeling process. The following inputs should be mentioned:

1. Land uses and land use acreages.

2. Population distribution according to land use.

3. Runoff (K) factors which represent the imperviousness of the land use, thus the relative ability of rainfall to flush pollutants from land surfaces.

4. Pollution coefficients, which assist in calculating the relative pollutant loading estimated to be washed from a given land use into the receiving water (lake, stream, river, bay) by surface runoff during the rain season. Pollution co-efficients were based upon water quality sampling of storm runoff throughout the Bay Area during the 1976-77 rain season. Approximately 454 sets of water quality samples were taken from 32 demonstration

watersheds. After analysis of the sample results, County members of the Surface Runoff Coordinating Committee met on May 18th and selected pollution coefficients to be used as a baseline for modeling purposes. Each county subsequently adjusted the baseline data to recognize local conditions. The resultant pollutant coefficients were selected by each county according to its need and used in the modeling process. Napa County used the five traditional parameters:

Bio-Chemical oxygen demand (BOD)
Suspended solids (SS) or (TSS)
Volatile suspended solids (VSS)
Total Nitrogen (TN)
Total Phosphorus (TP)

Appendix C displays the above inputs for the eleven watershed sub-areas in Napa County. Table 6-1 summarizes the MAC Model printout for years 1975, 1985 and 2000. Appendix E shows the location of the eleven watershed sub-areas.

B. SURFACE RUNOFF WATER QUALITY MONITORING DATA

1. Biological Field Survey

In January, 1977, and ABAG staff person visited four sites on Napa Creek. Observed was benthic production, physical condition of streambed and banks plus accumulation of silt and vegetable matter.

Solano Avenue

On a subjective biological index of 1 - 5 the Solano Avenue site rated lowest at 3.7, indicating a lower quality condition which was caused by poor condition of aquatic organisms. Substantial amounts of urban residential runoff flow past this site.

Browns Valley

The next highest index was 2.1 in Browns Valley. Aquatic organisms were observed to be in good condition, but the observer noted silt in the stream, much leaf accumulation and "...some effects of urbanization..." (litter) in a potentially high quality stream.

Napa Creek

A biological index of 1.8 was assigned a Napa Creek site 1 1/2 miles above Solano Avenue. The observer noted that in spite of no discernable flow, the organisms were surviving under moist rocks in a stream that was still of high quality. This site is upstream of most urban residential development.

Redwood Creek

A biological index of 1, high quality, was assigned the Redwood Creek site 3 1/2 miles upstream of Solano Avenue. The observer noted that the stream was extremely clean, and dissolved oxygen probably was at saturation limit. Surface runoff at this site flows from hillside woodlands and conifer forests interspersed with occasional residences and small hillside farms.

2. York Street Monitoring

Table 6-2 shows water quality data obtained from 5 storms occurring from January through March, 1977. All parameters were not sampled during each storm. The range of concentrations is due partially to variations in the volume of runoff capable of flushing pollutants off of the paved and unpaved surfaces as well as due partially to the accumulation of pollutants between storms. Sampled runoff flows on February 20 varied from 0.18 to 5.32 cubic feet per second (CFS); on March 24 from 0.45 to 6.44 CFS. Core parameters were flow weighted for use in MAC modeling.

3. Napa Creek Monitoring

Table 6-3 shows water quality data obtained from three storms occurring from January through March. These data are of limited value because the Napa Creek drainage basin never developed full overland flow and runoff during the monitoring period. Drought. Data may be considered to represent limited areas such as those abutting the creek plus urban residential areas draining to the creek through man-made channels.

4. Bacteria Monitoring in the Napa River

The Napa County Division of Environmental Health samples for Total Coliforms in the Napa River at locations ranging from Trancas Street to Edgerly Island. The Division samples monthly as time and other work demands permit. The overall objective is to determine bacteria counts relative to the State minimum standards for swimming and other water contact sports. Frequently the sampling stations are shifted in order to search for possible sources of the higher bacteria counts.

Table 6-4 displays information derived from samples taken January through July, 1977. This includes the months of dry weather plus months during which the York Street sampling occurred.

5. Napa River Baseline Water Quality Monitoring Data

Napa County Flood Control and Water Conservation District and USGS, jointly conduct a five year water quality baseline study on the Napa River. Tables 6-5a and 6-5b display a selected data based on monthly sampling at 10 sites from Napa to Calistoga.

High boron values at Calistoga are of interest. SS values probably reflect lack of sediments flushed from land surfaces during the 1975-76 and 1976-77 drought.

TABLE 6-1

MAC MODEL SUMMARY

MAJOR WATERSHED	SUB AREA	AREA (AC)	WATERSHED CHARACTERISTICS	LAND USE AND POPULATION DISTRIBUTION	ANNUAL POLLUTANT LOADS* (1000's of pounds) BOD	SS	VSS	TOT N	TOT P
UPPER NAPA RIVER	A	53,300	Hillsides ranging from forest to scrub growth. Open space, scattered residences and limited croplands	1975	304	14,953	2,482	126	11
		53,300		1985	305	14,954	2,482	126	11
		53,300		2000	305	14,954	2,482	126	11
UPPER NAPA RIVER	B	12,800	Flat and rolling lands, pasture and cropland, scattered residences and wineries. Peripheral development of Calistoga and St. Helena	1975	146	7,395	1,083	74	17
		12,300		1985	147	7,387	1,083	74	17
		12,300		2000	148	7,372	1,083	74	17
UPPER NAPA RIVER	C	1,500	Developed residential, commercial and industrial areas of Calistoga and St. Helena, accounts for developed area of Sanitarium.	1975	64	665	169	10	2
		2,000		1985	76	692	187	12	2
		2,000		2000	93	726	212	13	3
MIDDLE NAPA RIVER	A	78,500	Hillsides ranging from forest to scrub growth. Open space, scattered residences and limited croplands	1975	446	21,133	3,513	181	17
		78,500		1985	447	21,134	3,515	181	17
		78,500		2000	450	21,136	3,518	181	17
MIDDLE NAPA RIVER	B	34,900	Flat and rolling lands. Pasture and cropland, scattered residences, wineries and small scale commerce. Peripheral development of Yountville and Napa.	1975	387	18,230	2,708	184	41
		34,900		1985	391	18,231	2,711	185	41
		34,900		2000	397	18,232	2,717	185	41
MIDDLE NAPA RIVER	C	9,900	Developed residential, commercial and industrial areas of Yountville and Napa. Accounts for developed area of Angwin-Pacific Union College and Veterans Home.	1975	314	2,727	715	44	9
		9,900		1985	376	2,843	792	49	11
		9,900		2000	429	2,950	864	54	12
AMERICAN CANYON	A	31,100	Hillsides ranging from woodland to grassland. Salt ponds and marsh. Pasture, scattered residences.	1975	193	10,724	1,594	103	20
		31,100		1985	193	10,724	1,594	103	20
		31,100		2000	193	10,724	1,594	103	20
AMERICAN CANYON	B	12,000	Flat and rolling lands. Pasture and cropland. Scattered residences, small scale commerce and industrial.	1975	92	5,149	745	51	11
		11,400		1985	92	5,148	745	51	11
		11,400		2000	92	5,145	745	51	11
AMERICAN CANYON	C	900	Developed residential, limited commercial and limited industrial areas of American Canyon.	1975	17	196	49	3	1
		1,500		1985	24	208	57	3	1
		1,500		2000	31	222	68	4	1
WOODEN VALLEY	A	28,400	Hillsides ranging from woodland to grassland. Open space. Pasture, scattered residences.	1975	123	6,277	1,022	54	6
		28,400		1985	123	6,277	1,022	54	6
		28,400		2000	123	6,277	1,022	54	6
WOODEN VALLEY	B	2,800	Rolling lands, pasture and limited croplands. Scattered residences	1975	29	1,578	228	16	4
		2,800		1985	29	1,578	228	16	4
		2,800		2000	29	1,578	228	16	4

* Based upon 1969-70 Rainfall Year

TABLE 6-2

YORK STREET WATER QUALITY DATA

PARAMETER	UNIT	RANGE	FLOW WEIGHTED MEAN
BOD	mg/l	3 - 52	19.4
SS	mg/l	0.7 - 180	81
V SS	mg/l	4 - 100	35
Kjeldahl N	mg/l	.08 - 8.4	*
$NO_2 + NO_3$	mg/l	.19 - 3.89	*
T N	mg/l		1.4
T P	mg/l	0.21 - 0.73	.43
COD	mg/l	10 - 210	
T D S	mg/l	8 - 180	
Lead	mg/l	0.11 - 1.60	
Cadmium	mg/l	$<$0.001 - $<$0.0053	
Chromium	mg/l	0.005 - 0.018	
Mercury	mg/l	$<$0.001	
Silver	mg/l	$<$0.005 - $<$0.01	
Copper	mg/l	0.02 - 0.09	
Zinc	mg/l	0.06 - 0.39	
Total Coli	MPN/100 ml	4,000 - 2,400,000	
Fecal Coli	MPN/100 ml	240 - 2,400,000	
Fecal Strep	MPN/100 ml	24,000 - 240,000	
pH	-	5	
Oil film	-	Iridescence observed during nearly all storms.	

*Expressed as Total Nitrogen (T N)

TABLE 6-3

NAPA CREEK WATER QUALITY DATA

PARAMETER	UNIT	RANGE
BOD	mg/l	6.6 - 72
S S	mg/l	2 - 2540
V S S	mg/l	8 - 284
Kjeldahl N	mg/l	0.46 - 7.5
$NO_2 + NO_3$	mg/l	0.09 - 2.1
T N	mg/l	0.78 - 9.6
T P	mg/l	0.06 - 1.2
COD	mg/l	46 - 49
T D S	mg/l	106 - 176
Lead	mg/l	$<$0.01 - 0.3
Cadmium	mg/l	$<$0.01
Total Coli	MPN/100 ml	11,000
Fecal Coli	MPN/100 ml	2,700 - 4,700

TABLE 6-4

TOTAL COLIFORM
BACTERIA MONITORING DATA*

LOCATION	NUMBER OF SAMPLES	UNIT	RANGE
Lincoln Bridge	4	MPN/100 ml	240 - $\geq$2400
Railroad Bridge near First Street and mouth of Napa Creek	3	MPN/100 ml	460
Napa Boat Club Dock, near mouth of Tulocay Creek	5	MPN/100 ml	460 - 1100
River Park Marina	11	MPN/100 ml	43 - $\geq$2400
Kennedy Park Ramp	6	MPN/100 ml	43 - 460
Napa Valley Marina	13	MPN/100 ml	23 - 150
Edgerly Island at Wilcoxson's Resort	4	MPN/100 ml	23 - 93

*Derived from samples taken by the Napa County Division of Environmental Health January - July, 1977.

TABLE 6-5 a

NAPA RIVER BASELINE WATER QUALITY DATA

PARAMETER	UNIT	NO. OF SAMPLES	RANGE	MEAN
	OAK KNOLL,		October, 1975-March 1976	
pH	-	6	6.9 - 7.6	7.1
Boron	mg/l	6	0.55 - 0.82	0.7
D O	mg/l	6	8.7 -11.9	9.2
SS	mg/l	6	2.4 - 6.7	3.9
NO_3+NO_4	mg/l	5	<0.1 - 2.9	1.0
Phosphates PO_4	mg/l	5	<0.3 - 1.45	0.76
Total Coliform	MPN/100 ml	5	43.0 -460	157
	ST. HELENA, October, 1975 - March, 1976			
pH	-	6	6.6 - 7.2	6.9
Boron	mg/l	4	0.75 - 1.8	1.26
DO	mg/l	6	9.2 - 10.2	9.7
SS	mg/l	6	1.0 - 7.2	3.7
NO_3+NO_4	mg/l	4	0.4 - 1.3	8.6
Phosphate PO_4	mg/l	6	0.16 - 1.14	0.75
Total Coliform	MPN/100 ml	4	93.0 -2400	1013

TABLE 6-5b

NAPA RIVER BASELINE WATER QUALITY DATA

PARAMETER	UNIT	NO. OF SAMPLES	RANGE	MEAN
	LINCOLN AVENUE, CALISTOGA		October, 1975-March, 1976	
pH	-	6	6.6 - 7.6	6.9
Boron	mg/l	5	0.6 - 3.0	1.3
DO	mg/l	6	8.6 - 11.7	10.5
SS	mg/l	6	1.5 - 4.4	3.2
NO_3+NO_4	mg/l	5	0.01 - 0.67	0.25
Phosphates PO_4	mg/l	6	0.12 - 0.83	0.29
Total Coliform	MPN/100 ml	4	93.0 -1500	697

C. ANALYSIS OF EXISTING AND FUTURE WATER QUALITY PROBLEMS

1. Relationship of surface runoff (nonpoint) to point surface loads

Exploration of this relationship is a major tool in finding the significance of the pollutant loads shown in Table 6-1. Figures 6-1 and 6-2 compare certain pollutant concentrations from point and nonpoint sources, which are major contributors of water pollution problems. For comparison purposes, the Local Point Sources were represented by treated industrial discharge from Kaiser Steel, plus effluent discharge from the sewage treatment facilities of the Napa Sanitation District (NSD), the American Canyon County Water District (ACCWD) and Yountville. Data representing discharge from the facilities of the East Bay Municipal Utility District (EBMUD) was included to show the point source characteristics of a typical large, regional municipal sewage treatment plant. Local data is represented by weighted flow concentrations based on water quality sampled by the counties during the 1976-77 rain season. National data is also flow weighted and is based upon compilations by Metcalf and Eddy (ABAG consultant) of previous studies made, principally in the United States. Nonpoint sources in these two Tables are representative of the Middle Napa River Watershed only.

Of note are the relatively low concentrations of Bio-chemical oxygen demand (BOD), Total Nitrogen (TN) and Total Phosphorus (TP) originating from nonpoint sources compared to high concentrations from the point sources.

Because the subject point sources originate from urban areas, Table 6-6 is made to compare the pollutant mass loads in the urban areas (Sub-area C) *of the Middle Napa River and American Canyon watersheds. Here another distinction is introduced; the point mass loads from the municipal and industrial facilities are computed for 180 days only. This is done to make the comparisons over an equal time period, i.e., the approximate 180 day length of a typical rain season. Thus, the 1975 BOD point mass load of 198,000 pounds occurs over a 180 day period. It may be well kept in mind that this load doubles to about 396,000 pounds on an annual basis, while the nonpoint load of 331,000 pounds remains constant for either the 180 day or annual basis.

Again, using BOD as an example, the point mass load is projected to drop to 57,000 pounds by 1985, then increase to 72,000 pounds by 2000. This reflects anticipated improvement of sewage treatment capability, such as through the NSD and ACCWD joint advanced treatment plant (thus the apparent sharp reduction for the modeling year 1985) coupled with a projected population increase (thus the increase by the modeling year 2000).

*Urban and other sub-areas are described in Table 6-1.

Figure 6-3 displays the comparison in graph form. The graph emphasises the relatively high loads of BOD and suspended solids. Interestingly, these urban areas appear to produce relatively small loads of nutrients in the form of TN and TP.

2. Comparison of existing and future surface runoff pollutant loads

Figure 6-4 graphically displays BOD pollutant loadings shown on Table 6-1. The "C" areas (urban in character) indicate a definite stair step increase in loadings through 1975, 1985 and 2000. This is not evident in the B and A areas (developable and protected). The stair step occurs due to population increases in the urban areas, reflecting the County's policy of directing urban type developments toward urban areas. Projected population increases in the B and A areas were deemed too small to justify the tinkering necessary for MAC modeling.

What is important here, and as displayed in Figures 6-5 through 6-8, is that A and B areas show insignificant changes in pollutant loadings through the period 1975 through 2000. The same is generally true of the C areas, BOD excepted. BOD in the C areas of the Upper and Middle Napa River and American Canyon watersheds totals 395 thousand pounds for 1975. The total BOD then increases to 553 thousand pounds for year 2000, an increase of 40 percent. However, the total BOD loadings from all watersheds is 2,115 thousand pounds for 1975 and 2,290 thousand pounds for year 2000. An increase of only eight percent.

Consequently for purposes of this study there appears to be only minor changes in surface runoff loads through year 2000. Therefore, discussion of loads and their associated problems will generally refer to existing (1975)loads.

3. Ranking of sub-watersheds

Table 6-7 shows the ranking of sub-watersheds in order of contribution of pollutant loads. In each parameter the tendency is for the A areas to contribute more than the B areas which tend to contribute more than the C areas.

Table 6-8 shows contributions of pollutants in pounds per acre from each sub-watershed. The ranking of such contributions is displayed in Table 6-9. The BOD parameter clearly indicates that all C areas contribute at the greatest rate, followed in turn by the B and A areas. The SS parameter indicates that all B areas contribute at the greatest rate followed by a mixing of A and C areas. The TN and TP parameters indicate that B areas tend to contribute these nutrients at the greatest rate with a tendency for C areas to be next and A areas last.

Inspection of the above rankings does not point to any specific sub-watershed as the major source area. Ranking by pollutant loads (Table 6-7) indicates that the A areas are the largest contributors, but they also have the largest land areas. On the other hand, ranking of sub-areas by pounds of SS per acre of contribution (Table 6-9) indicates that B areas tend to contribute at the greatest rate, then C areas and then A areas. The BOD ranking of C, B and A tends to agree with pollutant concentrations assigned to land uses for the MAC modeling process. C sub-watersheds are dominated by developed residential, commercial and industrial land uses which were assigned the higher BOD concentrations, whereas the A sub-watersheds are dominated by hillside and open space land uses which were assigned the lowest BOD concentration.

Turning back to the graphs of pollutant loads (Figures 6-4 through 6-8) it is clear that although the higher pollutant concentrations are associated with urban (C) areas, the greater pollutant loads originate from the agricultural/developable (B) areas and open space/protected (A) areas. Also, Figure 6-3 and Table 6-6 indicate that compared to that most commonly perceived pollution, i.e., discharge from sewage treatment and industrial plants (point sources), surface runoff (non-point sources) contribute greater pollutant loads, with BOD and SS constituting the largest portion.

Considering the above it appears that, based upon the MAC modeling results, any efforts to reduce pollutant loadings must be made on a broad front. There will be no easy solutions such as focusing upon improved street sweeping and litter cleanup alone.

FIGURE 6-1

COMPARISON OF 1975 POLLUTANT CONCENTRATIONS, NONPOINT SOURCE VS. POINT SOURCE

BOD AND SUSPENDED SOLIDS

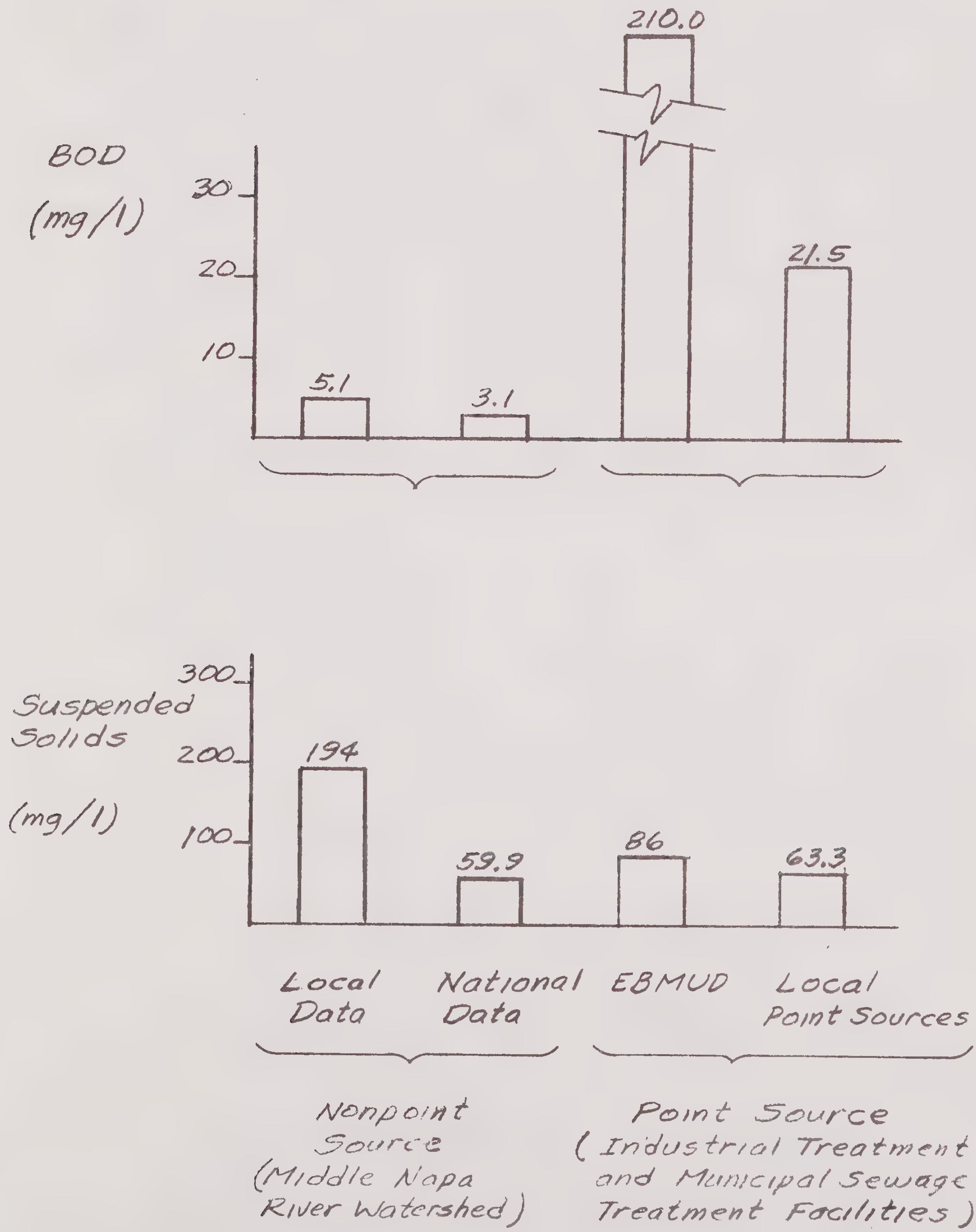


FIGURE 6-2

COMPARISON OF 1975
POLLUTANT CONCENTRATIONS
NONPOINT SOURCE VS. POINT SOURCE

TOTAL NITROGEN AND TOTAL PHOSPHORUS

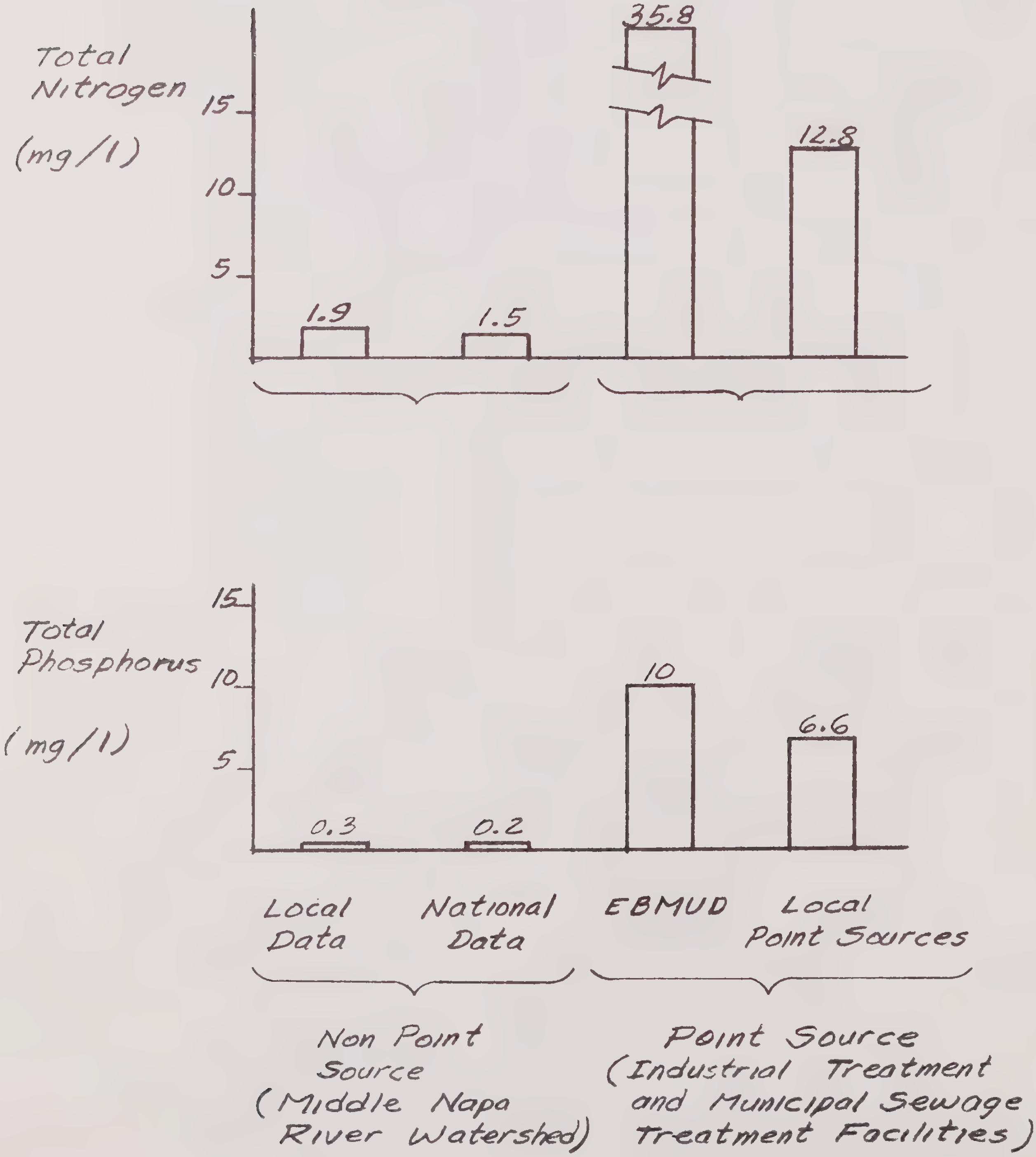


TABLE 6-6

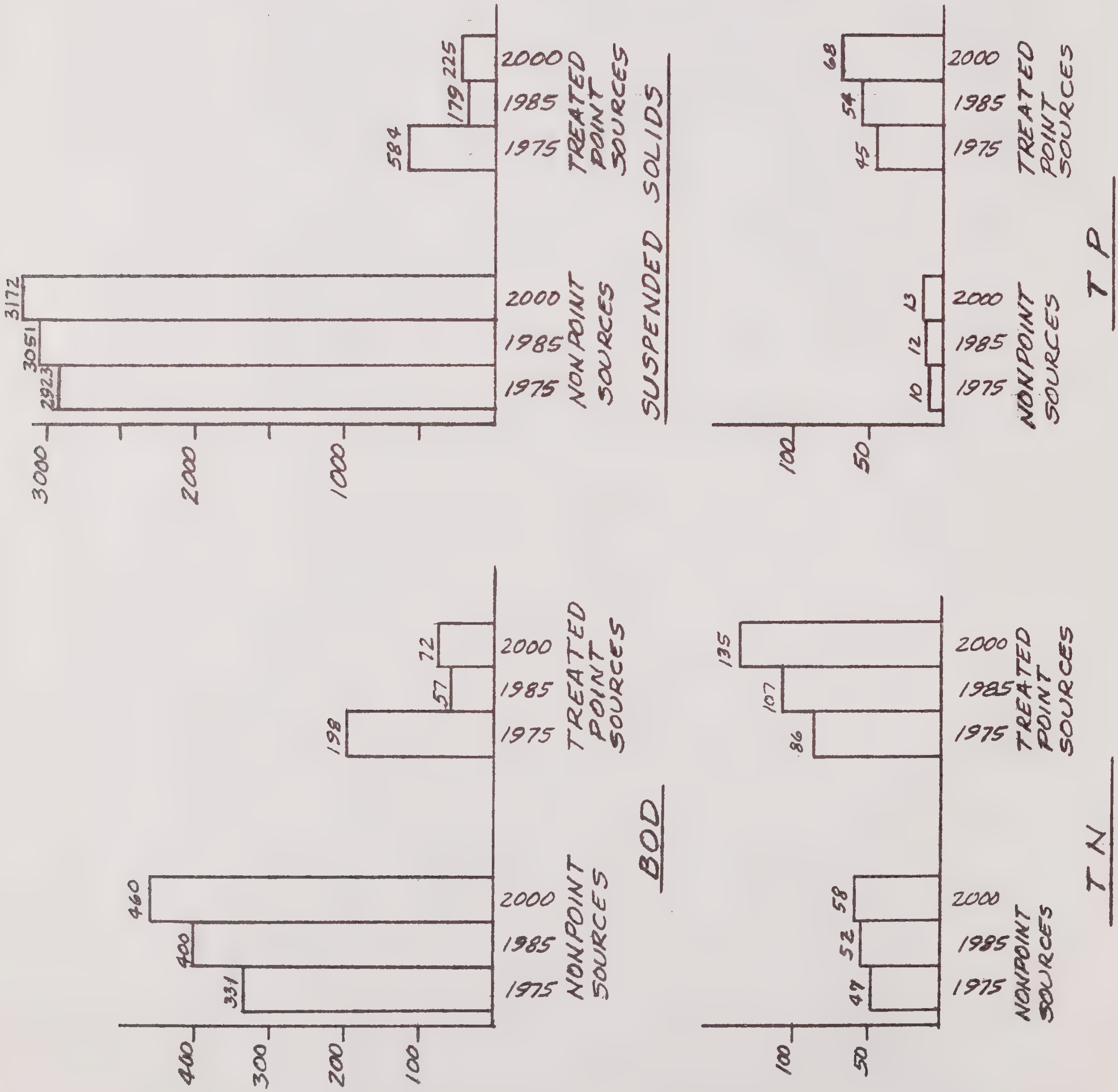
COMPARISON OF POLLUTANT MASS LOADS *
FROM NONPOINT AND POINT SOURCES IN MIDDLE
NAPA RIVER AND AMERICAN CANYON WATERSHEDS

Year	Parameter	Nonpoint Mass Loads Sub-Watersheds "C"	Nonpoint Mass Loads (Total Watersheds)	Point Mass Load **
1975	BOD	331	(1,449)	198
1985		400	(1,523)	57
2000		460	(1,592)	72
1975	TSS	2,923	(58,159)	584
1985		3,051	(58,288)	179
2000		3,172	(58,409)	225
1975	TN	47	(566)	86
1985		52	(572)	107
2000		58	(578)	135
1975	TP	10	(99)	45
1985		12	(101)	54
2000		13	(102)	68

*In thousands of pounds
**180 day rain season assumed

FIGURE 6-3

GRAPH COMPARISON OF POLLUTANT MASS LOADS * **
FROM NONPOINT AND POINT SOURCES IN
SUB-AREAS "C" OF THE
MIDDLE NAPA RIVER AND AMERICAN CANYON
WATERSHEDS



* In thousands of pounds
** 180 day rain season assumed

FIGURE 6-4
NAPA COUNTY
COMPARISON OF SUB-WATERSHED POLLUTION LOADS

BOD (In thousands of pounds)

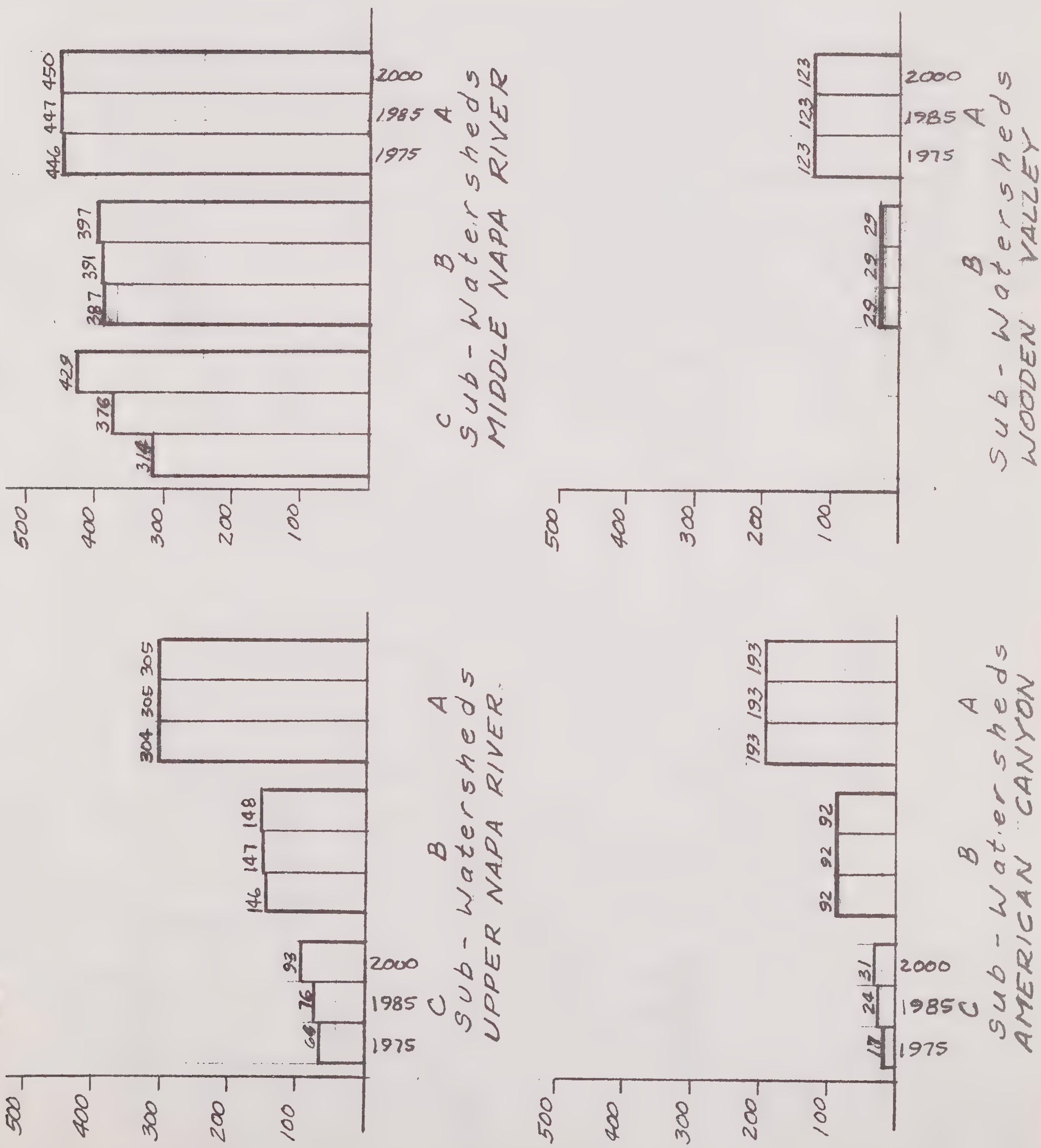


FIGURE 6-5
NAPA COUNTY
COMPARISON OF SUB-WATERSHED POLLUTANT LOADS

SS (THOUSANDS OF POUNDS)

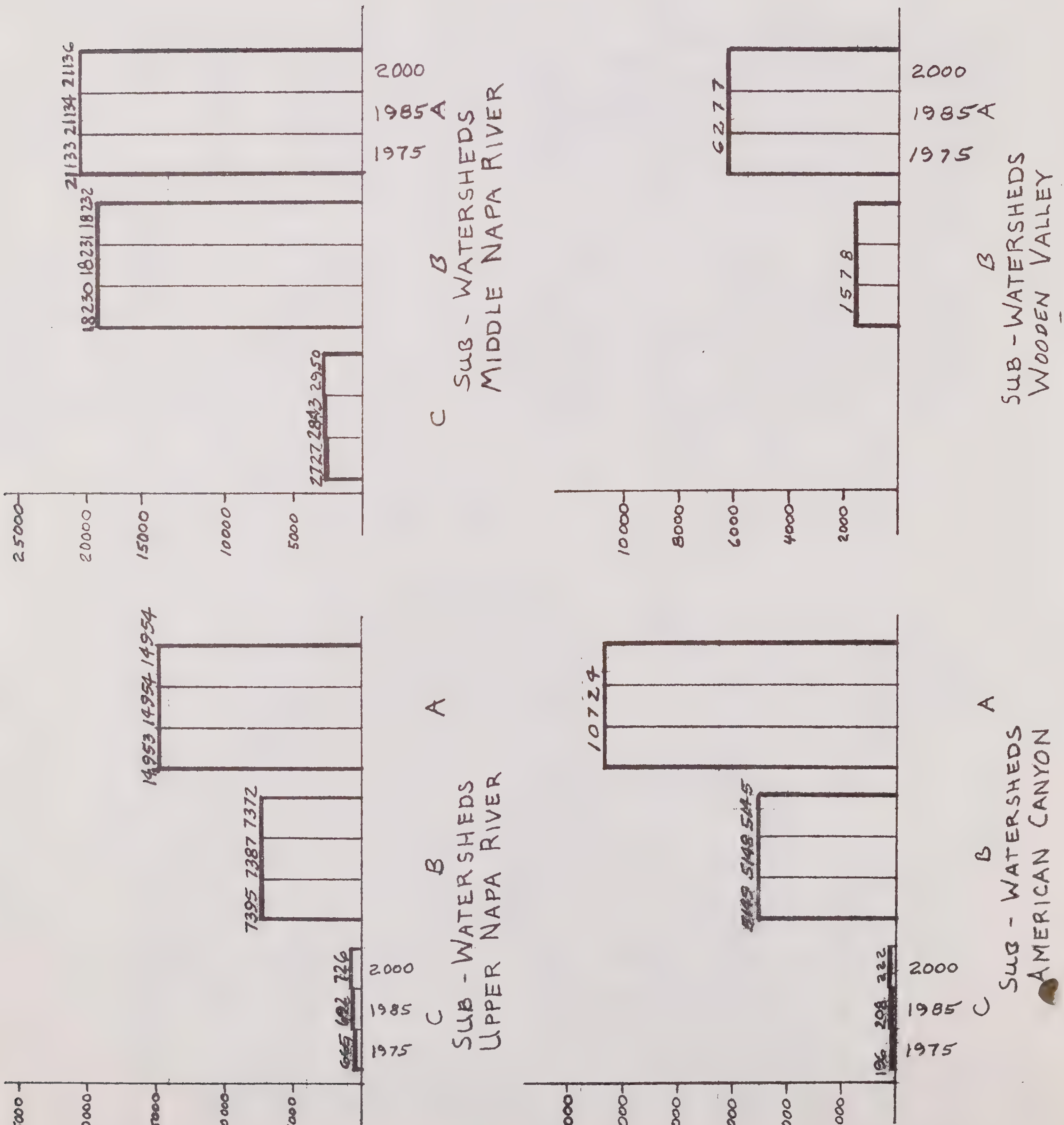


FIGURE 6-6
NAPA COUNTY
COMPARISON OF SUB-WATERSHED POLLUTANT LOADS

VSS (IN THOUSANDS OF POUNDS)

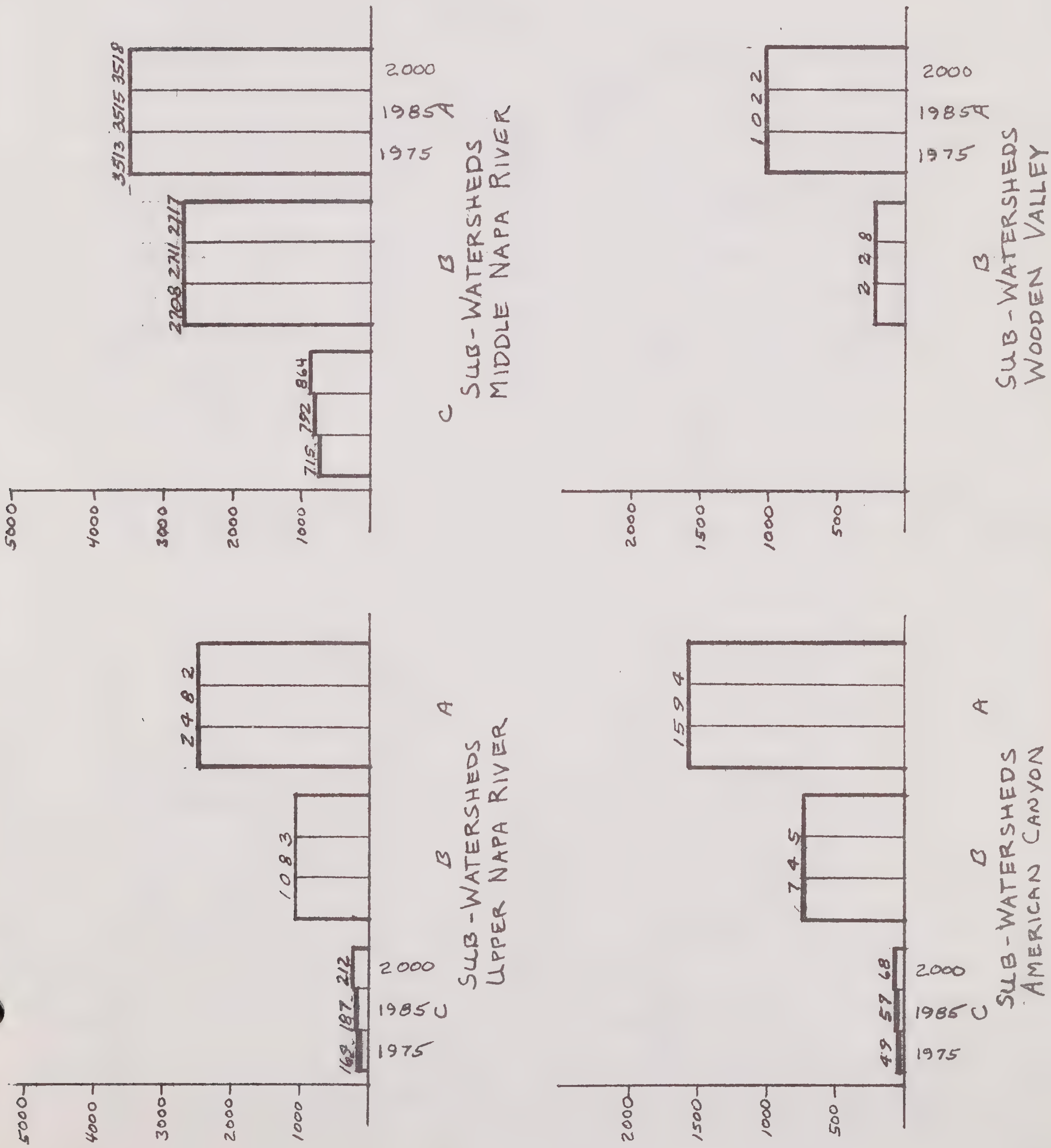


FIGURE 6-7
NAPA COUNTY
COMPARISON OF SUB-WATERSHED POLLUTANT LOADS

TOT N (IN THOUSANDS OF POUNDS)

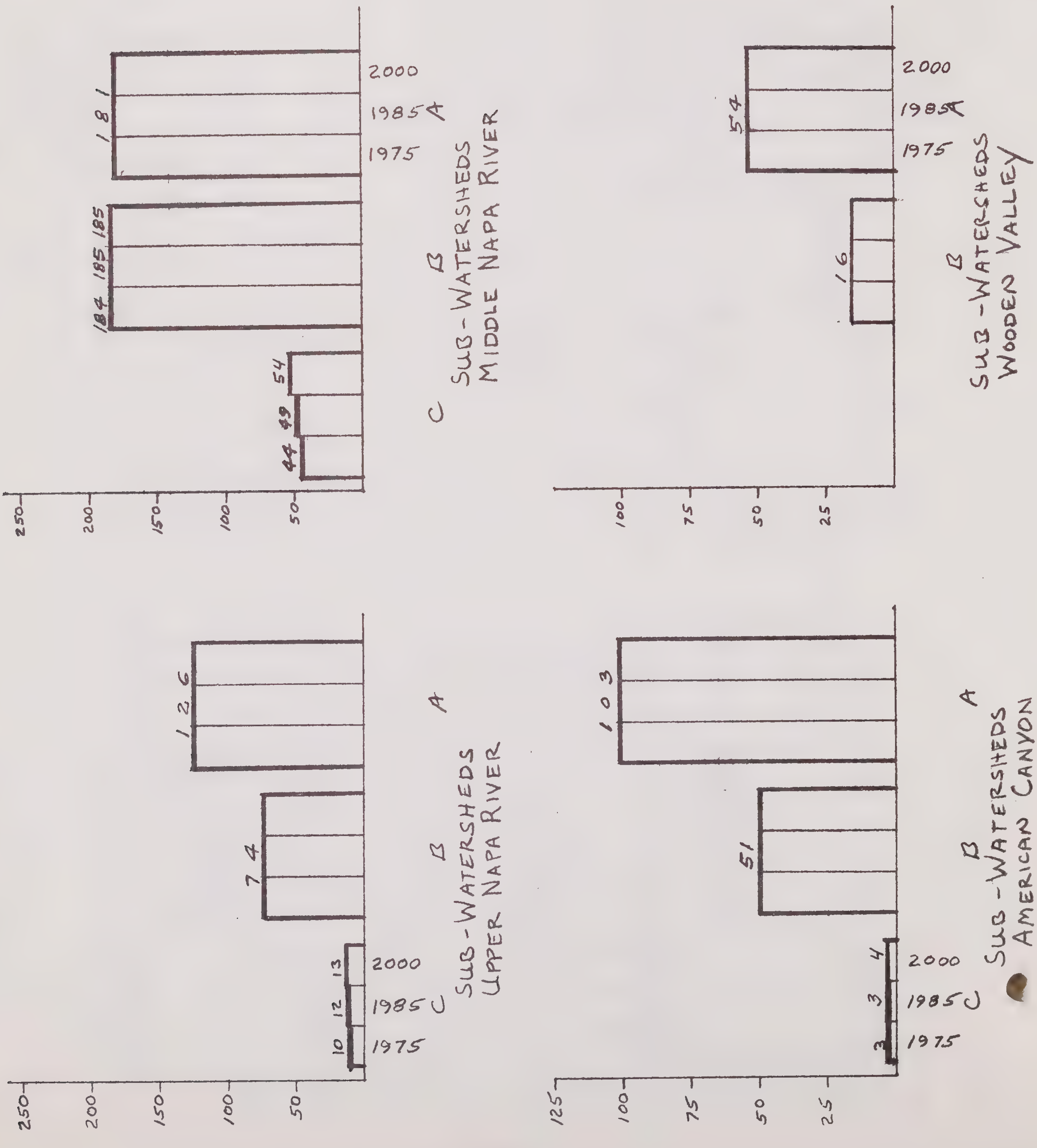


FIGURE 6-8
NAPA COUNTY
COMPARISON OF SUB-WATERSHED POLLUTANT LOADS

TOT P (IN THOUSANDS OF POUNDS)

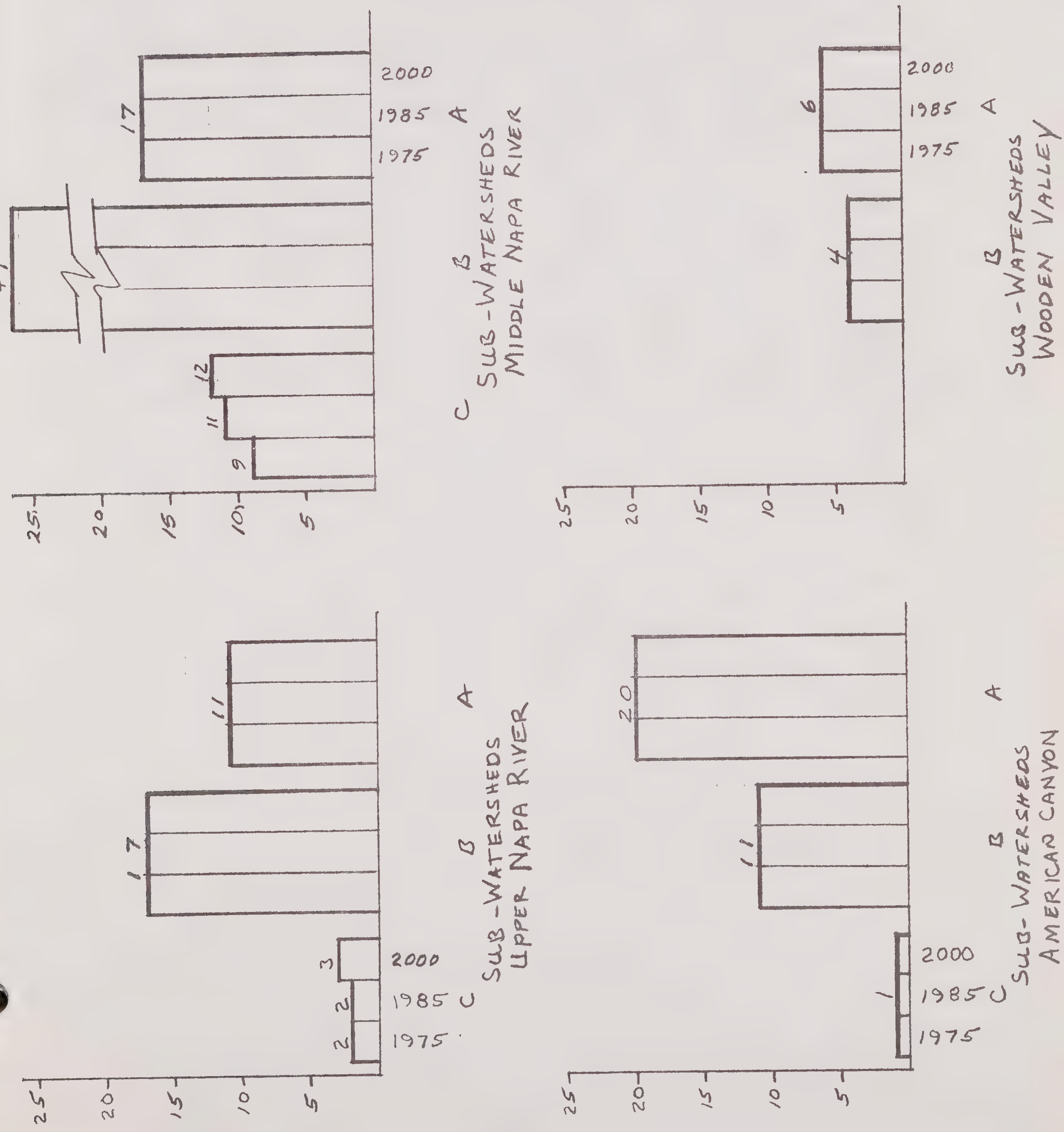


TABLE 6-7

RANKING OF POLLUTANT LOADS BY CONTRIBUTION FROM SUB-AREAS

1975 LOADS *

RANK	BOD Water-shed	BOD Sub-Area	SS Water-shed	SS Sub-Area	TN Water Shed	TN Sub-Area	TP Water-shed	TP Sub-Area
1	N 2	A	N 2	A	N 2	B	N 2	B
2	N 2	B	N 2	B	N 2	A	N 3	A
3	N 2	C	N 1	A	N 1	A	N 2	A
4	N 1	A	N 3	A	N 3	A	N 1	B
5	N 3	A	N 1	B	N 1	B	N 1	A
6	N 1	B	N 4	A	N 4	A	N 3	B
7	N 4	A	N 3	B	N 3	B	N 2	C
8	N 3	B	N 2	C	N 2	C	N 4	A
9	N 1	C	N 4	B	N 4	B	N 4	B
10	N 4	B	N 1	C	N 1	C	N 1	C
11	N 3	C	N 3	C	N 3	C	N 3	C

NOTE: Upper Napa River - N 1
Middle Napa River - N 2
American Canyon - N 3
Wooden Valley - N 4

* See Table 6-1

TABLE 6-8

CONTRIBUTIONS IN POUNDS / ACRE FROM SUB-AREA

YEAR 1975

WATER-SHED	SUB-AREA	BOD	SS	VSS	TOT N	TOT P
UPPER NAPA RIVER	A	5.70	280	46.6	2.4	.21
	B	11.4	578	85.	5.8	1.3
	C	42.7	443	113	6.7	1.3
MIDDLE NAPA RIVER	A	5.68	269	44.8	2.30	.22
	B	11.1	522	97.6	5.27	1.17
	C	31.7	275	72.2	4.44	.91
AMERICAN CANYON	A	6.2	345	51.3	3.3	.64
	B	7.73	429	82.1	4.25	1.92
	C	18.81	218	54.4	3.3	1.1
WOODEN VALLEY	A	4.3	221	36.	1.9	.21
	B	10.4	563	81.4	5.7	1.4

TABLE 6-9

RANKING IN POUNDS/ACRE OF CONTRIBUTIONS BY SUB-AREA TO TOTAL STUDY AREA POLLUTANT LOADS

1975

RANK	BOD		SS		TN		TP	
	WATER-SHED	SUB-AREA	WATER-SHED	SUB-AREA	WATER-SHED	SUB-AREA	WATER-SHED	SUB-AREA
1	N1	C	N1	B	N1	C	N4	B
2	N2	C	N4	B	N1	B	N1	B
3	N3	C	N2	B	N4	B	N1	C
4	N1	B	N1	C	N2	B	N2	B
5	N2	B	N3	B	N2	C	N3	C
6	N4	B	N3	A	N3	B	N3	B
7	N3	B	N1	A	N3	A	N2	C
8	N3	A	N2	C	N3	C	N3	A
9	N1	A	N2	A	N1	A	N2	A
10	N2	A	N4	A	N2	A	N4	A
11	N4	A	N3	C	N4	A	N1	A

NOTE: UPPER NAPA RIVER - N1
MIDDLE NAPA RIVER - N2
AMERICAN CANYON - N3
WOODEN VALLEY - N4

D. DISCUSSION

1. Bio-Chemical Oxygen Demand (BOD)

Based upon the MAC modeling results described in Section C, BOD loadings from agricultural and open space areas appear to make a significant contribution to the pollution load originating from the Napa River Watershed. Water Quality impacts upon the Bay have been computer modeled by ABAG staff. Preliminary results (5) show an overall BOD value of less than 0.5 mg/l bay-wide. This value increases to about 2.4 mg/l at the end of a 3 day storm then decreases to about 0.8 mg/l four days after the storm.

Oswald's study of the Napa River (3) indicates typical values of less than 2 mg/l and that the higher values usually did not exceed 10 mg./l. BOD rose to the higher values during the summer months due to algal production. Also greater fluctuations occured at the Kennedy Park and Third Street test stations than downriver. Oswald points out

that a lack of correlation with observed chemical oxygen demand (COD) levels indicates that the river contains dissolved substances (possibly of industrial origin) that are chemically stable in the sense that they do not exert a BOD but that the substances are unstable sufficiently to exert a COD.

Gustafson's study of the lower Napa River (1) noted that unfiltered effluent from the Napa Sanitation District's (NSD) treatment ponds had BOD values of 2.64± 0.92 mg/l and that filtered effluent had 1.74± 0.72 mg/l which indicates that algae and particulates in the effluent discharged from the NSD ponds could be a significant contribution to BOD loadings in the river.

The above modeling and studies indicate that the overall impact of surface runoff related BOD results in values that are not high but do occasionally exceed 10 mg/l. While it is desirable that BOD should not exceed 10 mg/l, the critical factor is its impact upon DO. BOD values should not be so high as to cause DO values in the receiving waters to fall below 5 mg/l.

In March, 1978 the NSD/American Canyon Joint Physical/Chemical Treatment Plant is scheduled to commence operating. There will be a significant reduction of treatment pond algae in the effluent. The river should be monitored for resultant changes in BOD values.

Gustafson (2) cautions that the seasonal changes in salinity in the lower river cause almost complete changes in the benthic biota. These changes mask the effects of the subject sanitary discharge study. It appears the same might be said regarding the effects of surface runoff upon the lower Napa River. A future review of data produced by NSD's on-going water quality monitoring program appears appropriate to answer questions regarding: (a) The effect of the new joint treatment plant. (b) The lack of correlation of COD and BOD values. (c) A better understanding of water quality in the lower Napa River.

2. Dissolved Oxygen (DO)

Depletion of DO can be caused by high organic content of sewage plant effluent. DO values in the Napa River upstream of Napa range from 8.6 to 11.9 according to samples taken as part of the County's ongoing Napa River Baseline Water Quality Study.

In the lower Napa River, Oswald's study (3) showed that there is relatively little stratification according to depth, and that fluctuations increased from downstream to upstream. In October, 1973, DO at the NSD effluent discharge, Kennedy Park and Third Street dropped to less than 5 which is considered the lower limit for fish survival. At other times during the test period, August 1970 to July 1974, typical levels at the test stations were about 8. The DO evaluation in general indicated healthy conditions in the river. Supersaturated DO values in excess of 12 mg/l occurred during algal bloom periods.

ABAG staff modeled DO values for the Bay (5). Preliminary results indicated a DO of about 8.4 (including benthic demand) during the summer months. This value was typical of the Bay. During the rain season DO increased to about 10.3. In the vicinity of the Napa River/ Sonoma Creek area the DO decreased to 8.8 on the third and last day of a storm and then increased to about 9.0 on the fourth day following the storm.

Low DO as a cause of fish kills should be questioned in some cases. For example, Wong's review of fish kills (7) includes a tabulation which lists a kill of 10,000 Sucker, 500 Crappie and 500 Sunfish in the Napa River August 18, 1976. This event occurred north of Trancas Street in the fresh water portion of the river above Napa.

The Department of Fish and Game had reported the suspected cause as low DO. 1976 was a drought year with extremely low flows in the fresh water portion of the river. Apparently there was so little water flowing that it was easily warmed by the August sun to the point that the DO fell below levels needed to sustain fish life. The basic cause of the fish kill is perceived in this surface runoff study as lack of fresh, flowing water, not low DO.

3. Suspended Solids (SS)

The limited sampling on Napa Creek yielded an SS high of 2540 mg/l during a brief period on January 2, 1977 when the runoff was observed to be heavily laden with silt. Samples taken under the County's on-going Napa River Baseline Water Quality Study show values ranging from 1.5 to 6.7 mg/l. The baseline samples are taken in good weather when it is safe for personnel to move about on the slippery banks. York Street samples ranged from 0.7 to 180 mg/l with a flow weighted mean of 81.

MAC modeling clearly indicates that open space and agriculture lands are the principal source of sediments.

Oswald (4) in his review of suspended sediments for 1956-62 flows past the Zinfandel gage on the Napa River concludes that erosion is a relatively severe problem in the hills surrounding the Napa Valley.

SS in the lower Napa river can be classified primarily as:

(a) Inorganic silt and mud transported from the watershed by large volume surface runoff. Organic silt and clay repeatedly resuspended by tidal and wind driven wave action.

(b) Phytoplankton algae and zooplankton.

Oswald (3) observed that SS was at a maximum during either Winter or Spring and that extreme SS values occurring in the river coincided with heavy runoff during the rain season. He could detect no discernable pattern of values along the longitudinal axis of the river except that water at the Napa/Solano County line was more turbid than at Third Street due to sediment resuspension caused by wind and tide.

Gustafson (2) noted that Phosphate values tended to increase during high tidal flow but the increase was not consistent. An increase in values appears reasonable considering that nutrients are known to be bound to the finer sediments. Resuspension of sediments would expose more nutrients to the sampling process.

In the same study he also comments that some areas of the river bottom are strewn with twigs and peaty fragments of tules. Therefor in the course of this surface runoff study such debris from natural (not manmade) sources should not be overlooked in assessing the impact of man-responsible pollutants relative to pollutants occurring naturally.

In his report on dredging in the Bay DiSalvo (6) comments:
"Estuaries unaffected by man are usually rich in both inorganic nutrients (nitrogen, phosphorus, trace elements) and organic nutrients (detritus) derived from biological production upstream of the estuary and within highly productive margins of the estuary such as the salt marshes. Ammonium nitrogen and orthophosphate are routinely found in high concentrations in interstitial waters of most estuarine sediments. These materials are released into the water column during sediment disturbance. Ammonium nitrogen is related to the kjeldahl nitrogen content of the sediment. Orthophosphate is controlled by the iron content of the sediment, as this nutrient is co-precipitated upon formation of iron hydroxides when iron in (anoxic) sedimentary interstitial waters is released into oxygenated waters. In San Francisco Bay, the large amount of iron in the sediments probably results in rapid capture of orthophosphate which might otherwise be released during a dredging operation. Ammonia release may be a significant occurrence during dredging".

In connection with this surface runoff study it appears reasonable to suggest that algae blooms in the Napa River are strongly related to resuspension of sediments and that the blooms occurred before the white man arrived.

Impacts of SS upon beneficial uses of water include but are not limited to the following:

a. Turbid water in municipal water systems. The City of Napa regularly uses water from the Northbay Aqueduct during the rain season instead of the cheaper but turbid water from Lake Hennessey. The soil mantle in the watershed is relatively thin and tends to be easily eroded. In the near future city voters must decide on a bond issue to improve facilities for treatment of Hennessey water. If full scale erosion control measures were implemented in the Hennessey watershed there is still no assurance that water treatment costs would be significantly reduced, however, erosion control measures could

significantly reduce the rate at which eroded soil is washed into the lake.

b. Mare Island Channel near the Carquinez Strait is dredged twice a year. The Sacramento Delta and the Napa River are listed as sources of sediments (6). Sediments must be dredged occasionally to facilitate river traffic to the Kaiser and Basalt plants. Sediments are dredged also from the River Park Marina and the Kennedy Park launching ramp.

c. Excessive sediments block storm water flows through street and highway culverts which requires additional manhours and money to clear the blockage and repair any damage caused by the resultant flooding.

d. Silt smothers trout and steelhead spawning gravels, fatally blocking the unhatched eggs from the oxygen laden water.

4. Heavy Metals

Several York Street water quality samples were analyzed for Cadmium Chromium, Copper, Lead, Mercury Silver and Zinc. Lead excepted, the results indicated that levels were within the ranges of naturally occurring waters which are treated for drinking purposes. For example, Mercury should be limited to 0.005 mg/l in water used for drinking purposes. The York Street samples indicated levels of 0.001 mg/l.

In the case of Lead, which is a serious body cumulative poison, the York Street samples ranged from 0.11 to 1.6 mg/l. Lead should be limited in drinking water to 0.05 and in agricultural water to 5.0 mg/l. Assuming that up-valley urban residential areas have runoff characteristics similar to York Street then Lead might be a problem if the downstream cities used the Napa River as a source of drinking water; but they don't.

At the beginning of the surface runoff study a primary concern was possible contamination of bay area shellfish by heavy metals. Special investigation contracted by ABAG has concluded that at this time heavy metals are not a primary contaminant, in the sense that bacteria and viruses are.

The impact of heavy metals upon the County's receiving waters is deemed negligable, except for Lead.

The automobile's gasoline engine is generally considered to be the principal source of Lead in this area. Air pollution standards will require reduced pollutant emissions from automobile engines over the next ten years. Therefore, it appears that Lead oriented control measures for surface runoff are not warranted for Napa County at this time.

5. Bacteria Monitoring in the Napa River

The State minimum standards for coliform counts in salt water contact sports areas is a most probable number per 100 Milliliters (MPN/100 ml) figure of not more than 1000. Table 6-4 shows that during January-July, 1977 this limited was exceeded in the lower Napa River at Lincoln Bridge, Napa Boat Club dock and River Park Marina. This means the river in the vicinity of Napa is still a problem area from the viewpoint of water contact sports standards. However, the river in this area is greatly improved over conditions ten years ago when Total Coliform counts were as high as 150,000 MPN/100 ml. This improvement is attributed by Health Officials to upgraded sanitary sewage treatment facilities and better animal husbandry management throughout the Napa River basin.

At this time it is not known if the present high counts are related to surface runoff or to sanitary sewage. Examination of the counts reveals no specific correlation to surface runoff. Counts at the Railroad Bridge near First Street are nominal, although this is where the largest single urbanized tributary, Napa Creek, drains into the river. River Park Marina experienced a count of 1100 on January 10, eight days after one of the season's heaviest storms; but showed a count of only 43 six days after a smaller storm on February 8. A count of 1100 occurred April 11th, twelve days after the March 29th storm, but a count of 2400 occurred on May 29th following an extended dry period. The above data suggests that urban surface runoff containing high bacteria counts, as evidenced by the York Street sampling, is substantially diluted as it mixes with the river's waters. Confirmation or rejection of this suggestion may be assisted if the monthly sampling can be taken shortly after rainfall without interfering with higher priority duties of Environmental Health Division personnel.

7. PROBLEM IDENTIFICATION

A. PROGRESS REPORT NO. 6, EXAMINATION OF EXISTING WATER QUALITY PROBLEMS IN NAPA COUNTY

On February 28, 1977 the Department of Public Works (DPW) prepared a progress report to ABAG. Included was a list of existing and potential problems thought to be within the scope of this study. Said problems had been identified at that earlier time from three view points:

1. As discussed in the Bay Basin Plan, and delineated on Base Maps prepared by ABAG.

2. As proposed by DPW based upon interviews with staff of other County departments and local governments.

3. As proposed by the Citizens Advisory Committee, Surface Runoff Management Plan.

Table 7-1 lists the problems, and they are discussed in the following section from the standpoint of investigations made during this study.

B. DISCUSSION

1. Algae blooms and low dissolved oxygen (DO) in the lower Napa River. Based on the discussion in Chapter 6, the low DO and algae blooms probably are interrelated and occur because of suspended solids (SS) originating from land surfaces and also originating from chlorinated algae floating in effluent from sewage treatment ponds.

2. Septic tanks on Edgerly Island.
   This is essentially a health problem although effluent from the systems probably contributes nutrients to the river, adding to the algae and low DO problem. Limited drain fields and high water table are the suspected causes.

3. Boron.
   Boron values in the upper Napa River near Calistoga sometimes exceed safe limits for irrigation purposes. Hot springs in the Calistoga area are the suspected origin.

4. Algae growth - plus stratification in fresh water lakes.
   MAC modeling and other investigations did not address this problem and time constraints did not permit documentation, although it is known that the City of St. Helena uses Copper Sulphate (bluestone) to control algae at Bell Canyon Reservoir and the City of Napa uses an experimental air bubble system.

5. High coliform counts in Conn Creek where it enters Lake Hennessey. MAC modeling and other investigations provided no insight to this problem. Septic tanks in the Angwin area are a suspected cause, but the possibility of an agricultural source should not be disregarded.

6. Degraded water quality in streams, drainage channels and the Napa River is caused by illicit dumping of refuse by residents along such watercourses. Garbage, crankcase oil, junk, even grass clippings, all contribute to elevated bacteria counts and BOD values in the watercourses.

7. Siltation downstream of Gordon Valley Ranches. This action contributes SS to the Suisun Bay where it will tend to depress DO values. It is identical to and will be included with the low DO problem described in (1) above.

8. Evidence of septic tank effluent in drain swale downstream of Auction Yard-Tower Road area near Kelly Road. MAC modeling and other investigations did not address this problem. Suspected causes are overburdened septic tank systems combined with impermeable soil strata. This problem is not confined to the Auction Yard-Tower Road area alone. It can occur in other areas that have undergone development.

TABLE 7-1

EXISTING AND POTENTIAL WATER QUALITY PROBLEMS

Location	Source	Type	Possible Cause	Existing Mitigation Measures
Lower Napa River	Basin Plan	Low dissolved oxygen	Non-point sources	Water quality investigation by Napa Sanitation District (NSD)
Mouth of Napa River	Basin Plan	Algae bloom	Nutrients from point and non-point sources	Implementation of stricter discharge requirements for sewage treatment plants
Napa River below 3rd St. Bridge, Napa	Basin Plan	Low dissolved oxygen	Non-point sources	Water quality investigation by NSD and Napa County Flood Control and Water Conservation District (NCFC&WCD)
Edgerly Island	Napa County Div. of Environmental Health	Septic tank systems create existing health problem & potential river pollution problem	Limited drain fields	Div. of Environmental Health investigating alternative solutions
Auction Yard area, Kelley Road	Div. of Environmental Health	Septic tank systems effluent	Overburdened systems, impermeable soil strata	Enforcement of standards by Div. of Environmental Health
Gordon Valley	Div. of Environmental Health	Potential siltation down stream of Gordon Valley Ranches	Powdery unstable soils underlying estate home development	Surveillance
Milliken Reservoir	Basin Plan	Algae and lake stratification	Non-point sources	None except water treatment by owner. Drainage basin is grassland, chaparral and wood land. Limited grazing and insignificant cultivation
Rector Reservoir	Basin Plan	Algae and lake stratification	Non-point sources	None except water treatment by owner. Drainage basin is chaparral and grassland. Virtually uncultivated and undeveloped

Angwin	Napa County Div. of Environmental Health and Basin Plan	Septic tank discharge to Conn Creek creates potential problem to Lake Hennessey	Overburdened and failing septic tank systems. Thin soil mantle	Enforcement of standards by Division of Environmental Health. Increase of minimum lot size to 5 acres by County's Conservation, Development and Planning Commission.
Lake Hennessey	Basin Plan	Algae	Non-point sources	Water treatment by owner
Bell Canyon	Basin Plan	Algae	Non-point sources	Water treatment by owner. Drainage basin is grassland and woodland. Insignificant cultivation and residential development.
Calistoga	NCFC&WCD	Potential boron problem to down stream agricultural users.	Discharge from hot springs and other groundwater sources.	Water quality monitoring. Search for sources.
River and streams	Napa County Dept. of Public Works	Potential general pollution	Indiscriminate dumping by residents along watercourses	Surveillance, enforcement of ordinances by Div. of Environmental Health as work priorities allow

8. ASSESSMENT OF CONTROL MEASURES

A. GUIDELINES

The variety of identified water quality problems allows consideration of a wide variety of control measures. Table 8-1 displays measures organized by the ABAG staff for possible use in plans developed by the counties. Of interest is the fact that portions of the measures listed are already implemented to a limited degree. For example, street cleaning (sweeping) is conducted by the cities for purposes of litter control and general aesthetics. However, it must be recognized that street sweeping is not conducted to the extent which would qualify it as a full scale water quality control measure: Fine particles are not removed, and parked cars often bar the sweeper from the strip adjacent to the curb where most litter and fine particles lie.

Mindful that cause and effect related to water quality problems is not presently well documented, and mindful that control measures may consist of intensification of certain current practices it appears that phasing is a key element.

Table 8-2 displays guidelines for controls and their increasing level of effort. Some control measures may be adequately implemented at step 4. Others may require increased levels of effort through step 6b or, in extreme situations, through step 7.

General conformance to the guidelines should aid the implementation of control measures which are founded upon exisitng practices where possible and are supported by reliable data and are acceptable to taxpayers.

B. EXISTING PRACTICES

In the course of reviewing Table 8-1 it becomes apparent that certain control measures have already been accomplished or are presently on-going. The following list recounts either past or on-going programs that can be related to the candidate control measures.

- In the 1960's the City of Napa and NSD completed the separation of sanitary sewers from storm drains, thus eliminating cross connections in Napa.

- County Division of Environmental Health and RWQCB are exploring financial and legal options of constructing sanitary sewage collection and treatment facilities at Edgerly Island. This is viewed as a health rather than just a water quality problem.

- Under requirements of RWQCB two large cattle feedlots in the County have either shut down or modified their operations sufficiently to reduce water quality degradation downstream of the feedlot.

- NSD conducts two water quality monitoring programs: (1) a three station program of monthly samplings as required by the RWQCB; (2) an extension of the District's Tidal Current, Mixing and Water Quality Study which will be terminated in late 1977.

- Discharge quality monitoring of municipal and private point sources under NPDES permit is administered through RWQCB.

- Water sampling for bacteria in the lower Napa River by Napa County Division of Environmental Health.

- Napa River Baseline Water Quality Analysis. Jointly funded and conducted by the Napa County Flood Control and Water Conservation District (FC&WCD) and USGS. 10 stations, monthly sampling.

- The County Department of Public Works and FC&WCD clean up illegally dumped refuse from publicaly maintained roads and drainage channels as other work demands permit. Cities perform equivalent tasks in their jurisdictions.

- The Napa County Resrouce Conservation District stands ready to provide technical advice related to agricultural erosion control.

- County Road improvement contract projects generally require grass seeding of cut and fill slopes. The same is required of land division and Use Permit developments.

- Under a permit system the County Agriculture Commissioner's office enforces State requirements related to agricultural and structural application of herbicides, pesticides and fungicides.

- Under the Fish and Game Code, the State Fish and Game Department controls alterations of a creek bed and bank plus the discharge of harmful materials into a waterway. Enforced through permits and monitoring of waterways.

- In the case of use permits there is a periodic review of activities and improvements for conformance to permit conditions. Review is by County department responsible for enforcement of applicable conditions.

- Earth grading permits are required for significant volumes. Administered in the County by the Building Inspection Division and the Department of Public Works in accordance with the Uniform Building Code. Administered in the City of Napa by its Building Inspection Department.

- Under the County's Watercourse Obstruction/Riparian Cover Ordinance, a permit is required along the Napa River and major streams for:

  (a) Construction of any obstruction in the channel

  (b) Any improvements, excepts tillage, within 50 feet of river or stream bank. Administered by FC&WCD.

- The County's logging ordinance is administered on permit basis by the Conservation, Development and Planning Department (CD&PD). The permit may require certain mitigations which are selected according to field conditions. Such mitigation could include, but would not be limited to: Prohibit skid trails on steeper slopes; Install water bars on access roads; Install erosion check dams.

- The County's Geothermal Ordinance is administered on a permit basis by the CD&PD. The permit may condition certain mitigation which is selected according to field conditions. In addition to the discharge requirements of the RWQCB, such mitigation may include, but is not limited to: Create streamside buffer areas; Install water bars on access roads; Install check dams; Haul drilled materials and drilling mud to Class II refuse disposal site.

- The County's solid waste (garbage) ordinance requires refuse pick up in specified zones. Enforced in County by Division of Environmental Health. Similar ordinances enforced in cities under contract with the Division. The Division uses the broad provisions of Chapter 12 of the State Sanitation Code to control discharge or dumping of harmful substances.

● Under "nuisances provisions" of existing ordinances littering and illegal refuse dumping are controlled in the County by the Sheriff and in the cities by police departments.

● Animal Control ordinances (mainly for rabies and stray animals) are enforced in the County by the Animal Control Division of the County Health Department and in the cities under contracts with the Division.

● The County amended the Land Use Element of its General Plan in 1975. Under the category of Open Space and Watershed Policies the Plan states"...The County shall protect natural areas having slopes of 15 percent or more for ... erosion protection...". Under the category of Residential Policies, Urbanizing Growth, the Plan states: "The County should enact and enforce regulations encouraging the concentration of urbanized residential growth within the County's existing cities and urban areas." Currently the CD&PD is rezoning about 3000 acres on the north edge of Napa into an Agriculture Preserve zone. Among the results will be greatly reduced potential for semi-urban homesites in a rural area. Under the category of Residential Policies, the plan states: "The County should assume that the density of development in the ... Angwin Area precludes extensive future subdivision activity based on septic tanks..."

● Interested sportsmen have formed Napa River Steelhead Unlimited, Inc., and organization whose goal is to restore good steelhead runs in the Napa River. Objectives of this new organization include an Education/Legislative effort plus physical improvement of stream and river habitat. The club has sponsored two successful cleanup days removing larger pieces of rubbish from the river at Napa and St. Helena.

● The Napa County Planning Commission requests comments from water supply reservoir owners regarding developments proposed in the reservoir watershed.

TABLE 8-1

CANDIDATE CONTROL MEASURES

I. PREVENT CONTAMINANTS FROM REACHING THE SURFACE

Control chemicals
Control dumping and direct discharge
Control littering and dogs
Control auto and other emissions

II. IMPROVE METHODS OF COLLECTING OR REDUCING CONTAMINANT EROSION PRIOR TO RAINSTORM

Street cleaning
Clean storm drain system
Regrade disturbed areas
Reseed or apply veg. cover to bare slopes
Control erosion at construction sites
Regulate construction schedules
Use efficient tillage and plowing practices
Insure proper operation of septic tanks

III. REDUCE VOLUME AND PEAK OF STORM WATER RUNOFF

Develop slope density standards
Maintain open space
Control development patterns
Develop buffer strip requirements near streams
Develop recreational retention basins
Control roof drains
Construct detention and storage basins
Increase perviousness of surfaces
Require minimum levels of pervious surfaces for new construction
Modify drainage basin
Stabilize and redesign channels
Remove debris in channels, pipes and inlets to improve flow

IV. REDIRECT, DETAIN AND TREAT RUNOFF PRIOR TO DISCHARGE

Replace cross connections
Rechannel runoff to prevent flow over critical areas
Redisign curb and gutter
Trap sediments and solids by use of catch basins
Impound runoff in upstream channels
Construct on-line and off-line storage
Construct treatment facilities
Use existing collection and treatment facilities

TABLE 8-2
PROPOSED
LOCAL AGENCY GUIDELINES

1. Maintain and utilize present level of effort

   - Regulation
   - Funding
   - Manpower
   - Maintenance and construction

2. Control problems presently supported by adequate documentation and quantification

3. Survey, monitor, document and quantify problems sufficient to support incremental level of controls. When available data is insufficient then carry out demonstration program to develop supporting data.

4. Make data available to agency staff

   - Permit processing and other regulation
   - Agency construction and building operations
   - School curricula

5. Establish standards* necessary to achieve control

6a. Implement control measure within agency

   - Administration
   - Funding
   - Operations (maintenance & construction)

6b. Implement control measure externally through regulation procedures

   - Subdivision processing
   - Use permits
   - Grading permits
   - Building permits
   - Agriculture and structure pesticides

7. Create and provide funding for additional legislation and institutions sufficient to achieve desired control

   - Effective for "retrofit" requirements

*(administrative, design and operational standards)

C. SELECTION OF CONTROL MEASURES

At a meeting of the Counties' Surface Runoff Coordination Group on July 12, 1977, a consensus was reached on a number of issues related to the development of the Bay Area - wide surface runoff management plan. The five main points were as follows:

1. The Surface Runoff Management Plan should be placed in a 6 year time frame.
2. Initially Year 1 and Year 2 will be program specific (August, 1977 - June, 1979).
3. Description of control measures and their implementation should reflect a phasing schedule which is tied to a continuing planning process.
4. Initial control measures to be implemented shall be identified as part of a series of measures to be considered over time.
5. Monitoring and evaluation of control measures and resultant water quality shall be used to determine when control measures are appropriate, inappropriate or not being implemented properly.

Keeping in mind that candidate control measures selected for implementation should be implemented in accordance with the Local Agency Guidelines (Table 8-2) it becomes apparent that immediate efforts will generally be directed toward the accumulation of data. After data accumulation is completed an appropriate control measure can be selected, standards can be set and the measure can be implemented.

Table 11-1 displays control measures recommended as Napa County's Surface Runoff Management Plan. Phase I (November 1977 to June 1979) relates to Years 1 and 2 of the above mentioned six year time frame. Control measures for this phase are program specific. Phase II runs from July 1979 to June 1983. Control measures for Phase II are to be developed under the Continuing Planning Process.

9. CONTINUING PLANNING PROCESS

Napa County's Surface Runoff Management Plan, like that of other Bay Area counties, is intended to be flexible. To be effective it must be capable of responding to the inevitable changes regarding water quality problems. The tool of this capability will be the Continuing Planning Process.

Cause and effect related to water quality problems such as algae bloom and low dissolved oxygen in the lower Napa River are not well understood. Worse, the quantitative effectiveness of most candidate control measures is not well documented. Consequently, control measures recommended in this Plan are rudimentary and cautious.

A Continuing Planning Process would provide means of developing and refining control measures appropriate for Napa County through knowledge and data gained from preceding work. Such preceding work may be within or outside the County.

Phase I is generally concerned with data accumulation. Phase II will generally be concerned with developing and implementing control measures. Most continuing planning process work will occur during Phase II.

Process objectives can be summarized as follows:

- Designate single agency responsible for implementation and management of this Surface Runoff Management Plan.
- Provide single location for accumulation of results and findings of investigations and programs initiated within the County or in other areas.
- Accomplish or coordinate control measures outlined in the Plan.

The Napa County Flood Control and Water Conservation District is responsible for the Napa River Water Quality Baseline Study plus an on-going Well Water Level Monitoring Program plus other County-Wide water supply, water quality and flood control projects. The Department of Public Works is lead department for this study, but both the Department and the District are under the supervision of the Public Works Director who is also the District Engineer.

An alternative would be the creation of a special office to pursue the goals and objectives of this Plan. A special office would tend to overlap existing district operations such as the Napa River Baseline Study.

The District with its existing water quality functions and with its existing liaison between the cities and other county departments appears to be the appropriate agency for implementing and managing the Plan.

10. CONCLUSIONS

A. INVESTIGATIONS

Surface runoff from all land surfaces creates significant impacts upon water quality in the receiving waters.

On the issue of existing surface runoff pollutant loads compared to future loads, there is no significant difference between the two. This assumes current land use and population growth policies will be continued.

Water quality problems exist in the receiving waters, but they are difficult to quantify.

General cause and effect of pollutants is understood. But the specific impact upon the receiving waters is not. For example, the impact of a given pollution coefficient for suspended solids cannot be calculated in terms of a specific value of dissolved oxygen in the Napa River or the municipal reservoirs.

BOD and SS produce the more significant pollutant loadings and these should receive the greatest attention when additional control measures are implemented.

As municipal sewage treatment and industrial treatment plant (point source) discharges are upgraded and produce less pollutant loads, the loads produced by surface runoff (non-point sources) will bear a greater share of responsibility for water quality problems in the receiving waters.

Discharge from the nearly completed Joint Physical/Chemical Treatment Plant to be operated by NSD and ACCWD may significantly reduce SS loadings in the lower Napa River.

Heavy metals do not appear to create potential pollution problems in the receiving waters of Napa County.

Boron occurs naturally in the waters of the Napa River watershed, but Boron values in the upper Napa River sometimes exceed safe limits for irrigation purposes.

B. PROBLEMS

Water quality problems and their apparent or suspected causes are listed below:

Problem	Apparent/Suspected Cause
Algae blooms and low DO in the Lower Napa River	Suspended solids (inorganic/organic) eroded or washed from land surfaces. Suspended solids (organic) in sewage treatment plant effluent.
Evidence of septic tank effluent in Edgerly Island drainage ditches	Limited septic tank drain field and high water table
Boron values in upper Napa sometimes exceed safe limits for irrigation.	Hot springs in Calistoga area
Algae growth plus stratification in fresh water lakes	Suspended solids (inorganic/organic) eroded or washed from land surfaces.
High coliform counts in Conn Creek at Lake Hennessey	Septic tanks or agriculture source in watersheds
Degraded water quality in streams, drainage channels and Napa River	Illicit dumping of refuse by residents bordering watercourse
Evidence of septic tank effluent in drainage swale near Auction Yard area at Kelly Road.	Overloaded septic tank systems and impermeable soil strata

C. CONTROL MEASURES

The development of control measures should be an orderly incremental procedure beginning with survey, definition and quantification of problems followed by education and standards setting followed by implementation of the control measure.

Existing practices useful in reducing water quality problems have been udnerway for years. However, water quality itself has often been a secondary goal.

D. CONTINUING PLANNING PROCESS

A continuing planning process is necessary to assure that the Plan is implemented on schedule and that the Plan utilizes or develops data appropriate to Napa County.

The Napa County Flood Control and Water Conservation District appears to be the appropriate agency to manage and implement the Plan.

II. RECOMMENDATIONS

A. GENERAL

Napa County's Surface Runoff Management Plan should be implemented in accordance with the Proposed Local Agency Guidelines listed in Table 8-2. That is, existing levels of effort (for example, street sweeping) which are sometimes reduced by budget cutbacks should be maintained in cases where surface runoff water quality is one of the benefits. Also, local agencies should adequately document and quantify problems before implementing control measures. The control measures should be implemented step-wise in such manner that their results can be measured and their effectiveness determined prior to the agencies considering additional control measures.

The following discussion addresses each of the identified problems. Control measures, schedule and cost estimates are tabulated in Tables 11-1, 2 and 3 respectively.

B. EVIDENCE OF SEPTIC TANK EFFLUENT IN EDGERLY ISLAND DRAINAGE DITCHES

High water table and clayey soils are probably responsible for the appearance of septic tank effluent in the drainage ditches. The effluent constitutes a potential health problem and has the potential to degrade water quality locally in the river.

Possible solutions have been investigated by the County's Division of Environmental Health (EH) and Department of Public Works (DPW). A sewage collection and treatment facility is proposed.

Currently EH is investigating recent technological advances in sewage treatment. During Phase I EH could complete its investigations and initiate an application for a federal 201 grant.

Construction of the collection and treatment facility could be accomplished during Phase II.

Administration and investigation is a normal part of EH operations and will be financed by general revenues. Design and construction of the facility could be financed by the 201 grant with the local share borne by an assessment district.

C. EVIDENCE OF SEPTIC TANK EFFLUENT IN DRAINAGE SWALE NEAR AUCTION YARD - TOWER ROAD AREA

Occasionally problems arise in areas which are undergoing development and which are sewered by septic tanks. The Auction Yard-Tower Road area is typical of these areas. The problem here was solved when one business enterprise upgraded its septic tank system

at the request of Environmental Health. Existing septic system technology and regulations are deemed adequate to control problems as they develop. Unlike the Edgerly Island case, the problem discussed here tends to occur when one or a few systems malfunction in an area where most systems are operating satisfactorily.

As part of its normal operations which are funded by general revenues, Environmental Health surveys areas undergoing development and requires upgrading of septic systems where applicable. Naturally, this activity must continue through and beyond Phases I and II.

D. HIGH COLIFORM COUNTS IN CONN CREEK AT LAKE HENNESSEY

Chiles, Sage and Conn Creeks drain into Lake Hennessey. City of Napa Water Department personnel take water quality samples of the three streams and they have noticed that Conn Creek samples display significantly higher fecal coliform counts. Water quality in the lake would be improved if the source (s) of the coliforms were located and the coliform population were reduced.

During Phase I, the County Department of Public Works (DPW) should sample Conn Creek from Lake Hennessey through Angwin to locate the source (s). If the location can be determined then EH could determine the magnitude of the coliform production problem and its impact upon the source area. In consultation with the City of Napa's Water Department, EH could then determine the impact upon Lake Hennessey. The above actions of the DPW and EH could be financed by redirected funds of the County's Surface Runoff Contract with ABAG. Estimated costs are shown on Table 11-3.

Control of the above problem should be initiated by EH using existing regulations and powers. Funding for the above control may be available through the above contract until June, 1978 (Table 11-3). Afterward, general revenue monies would be required.

At the beginning of Phase II EH should assess the effectiveness of existing regulations and powers in controlling the problem. If control is not well underway, then EH should consider additional control measures. These could include additional land use restrictions, creating a septic tank maintenance district and restricting farm animals from streams. Funding for Phase II activities would be from general revenue unless federal grants become available.

The State Regional Water Quality Control Board and the State Health Department have the power to force action if they believe local control measures are inadequate.

E. BORON VALUES IN UPPER NAPA RIVER SOMETIMES EXCEED IRRIGATION STANDARDS

Water containing boron in excess of 3 milligrams per liter can be detrimental to crops. According to the ongoing (upper) Napa River Water Quality Base Line Analysis, water in the Napa River

near Calistoga occasionally exceeds the above figure. Downstream riparian owners use the river water for irrigation and frost protection.

The boron values should be reduced to an acceptable level. During Phase I and the remainder of the Base Line Analysis, FC & WCD should use the Base Line water sampling activities to locate boron sources such as at wells or springs. This effort could be assisted by brief, visual reconnaissance and limited sampling at little extra cost by Base Line Analysis personnel while they are in the Calistoga area.

During Phase II, or earlier if practical, FC & WCD and the City of Calistoga should undertake reduction of boron laden discharge through voluntary compliance by owners of the wells and springs. Where the owners refuse to cooperate and the problem persists, it may be necessary for the City of Calistoga and the County to use their existing regulatory powers. The County's Conservation Development and Planning Department may utilize portions of the Geothermal Ordinance to reduce discharge.

Costs of the above Phase I and II activities would be borne by general revenues. Phase I estimated costs are shown in Table 11-3.

RWQCB can force action if County and City controls are not effective.

It should be pointed out that voluntary or mandatory discharge reduction may not be wholly effective until the present drought ends: new wells developed to relieve Calistoga's severe water shortage may result in increased boron levels in the Napa River.

F. ALGAE BLOOM AND LOW DISSOLVED OXYGEN IN THE LOWER NAPA RIVER

Suspended solids and BOD loadings are suspected as the primary cause. When the Joint Chemical/Physical Treatment Plant begins treating sanitary sewer effluent from Napa Sanitation District and American Canyon County Water District, the suspended solids loading in the river may be significantly reduced. In the meantime, all public agencies should initiate low or no cost efforts to reduce flow of organic and inorganic suspended solids (e.g. eroded soil) into the streams and river.

During Phase I FC & WCD should conduct an overview of the water quality trends and look for potentially troublesome changes in the Napa River through a periodic (perhaps semi-annual) review of the results of the following water quality sampling programs:

a. Final monitoring phase of the Napa Sanitation District's (lower) Napa River Study Program.

b. The Napa Sanitation District's (NSD) water quality monitoring program required by the RWQCB.

c. The FC & WCD (upper) Napa River Baseline Water Quality Analysis.

In Phase II FC & WCD, working in conjunction with RWQCB should determine the condition and trend of water quality as based upon Phase I sampling. At this time both agencies should decide if the water quality trends warrant additional control measures. If so, both agencies should develop data related to the magnitude of the problems in order to provide factual support for the need of the additional control measures. When the data is developed, both agencies, acting within their appropriate jurisdictions, should seek implementation of the control measures.

The above work can be funded from each agency's general revenue sources. Where the effectiveness of a control measure is in question and supporting data is deemed not reliable, a demonstration project should be considered. Federally approved demonstration projects could be funded under a 75% federal and 25% local share.

The development of control measures should follow the Proposed Local Agency Guidelines discussed in Chapter 8, Section A and displayed in Table 8-2. That is, first efforts at control should utilize existing practices and regulations, and additional control measures should be supported by adequate data.

During Phase I, the DPW should obtain from ABAG/EPA, pamphlets describing low cost, small scale measures that local agencies can use to reduce the wash-off of soil, leaves and other bio-degradeable materials into the watercourses. Ideally, the pamphlets should contain information including, but not limited to the following examples:

- Encourage grassed strip adjacent to watercourse in order to filter sheet flow from adjoining paved surfaces (Planning Department)

- Encourage maximum amount of pervious surfaces for new or reconstructed developments. (Planning Department)

- Require check dam and/or silt basin for all construction still underway after beginning of rain season. (Public Works and Building Inspection)

- Require that erosive characteristics of soil be addressed in all soils engineering or geologic reports. (Public Works)

- Encourage terraced cut and fill slopes (Public Works and Building Inspection)

- Consider temporary or permanent silt basin for newly developed areas. (Public Works and Building Inspection)

- Defer seeding of graded areas until commencement of rain season. (Public Works and Building Inspection)

- Attach educational erosion control flyer to grading permit. (Public Works and Building Inspection)

- Watch natural and manmade waterways for excessive buildup of silt and notify upstream owners or agency which is responsible for control. (Public Works, Maintenance)

- Revise street sweeping schedules to emphasize leaf pickup during fall and winter. (Public Works, Maintenance)

- Encourage streambank protection and stabilization (Resource Conservation District)

- Enourage pasture management to reduce overgrazing. (Resource Conservation District)

The pamphlets would be distributed to applicable local agencies involved with regulation, design or operation of construction or maintenance activities. It should be noted that the Resource Conservation District has,through the Soil Conservation Service, considerable expertise in good erosion control practices which are especially applicable to the non-urban areas.

The cost of this Phase I action is shown in Table 11-3 and can be covered by redirected Surface Runoff Contract Funds.

Also during Phase I, the local agencies should instruct their staff to review existing regulatory, design, operation and maintenance practices for low or no cost opportunities to reduce water pollution caused by surface runoff. Ideally, the review should be made in conjunction with the above mentioned distribution of pamphlets describing small scale measures, and the review should be for the purpose of seeking similar opportunities. It is anticipated that no additional personnel would be hired to perform this work. Existing personnel could perform the review and resultant low cost control measures as part of their normal work.

The costs of the local agencies' reviews would be borne by their respective general revenues. The estimated costs are shown on Table 11-3.

G. ALGAE GROWTH PLUS STRATIFICATION IN FRESH WATER RESERVOIRS

Algae growth is encouraged by nutrients deposited into the reservoirs through surface runoff. Although nutrient deposition occurs naturally from undeveloped hillsides, the amounts of nutrients can be substantially increased by upstream development and agricultural practices. Stratification, which may occur naturally, can be increased through algae

growth. The result is increased taste and odor problems in the drinking water and resultant higher water treatment costs. Also there is the potential of siltation causing a significant reduction of reservoir capacity.

During Phase I, the Yountville Veterans Home and the cities of Napa and St. Helena should continue their water quality monitoring at Rector Reservoir, Milliken Reservoir, Lake Hennessey and Bell Canyon Reservoir to determine the nature and magnitude of such water quality problems. When the problems have been quantified, the reservoir owners should determine applicable control measures whose effectiveness can be supported by adequate data.

During Phase II, the appropriate control measures should be implemented. If the proposed control measures are not supported by reliable data (perhaps from a demonstration project in a similar area) then a local demonstration project should be implemented in order to develop the necessary data.

Estimated costs of Phase I activities to determine problems are shown on Table 11-3. Phase II costs necessary to implement control measures would depend on the type of measure and most likely would be borne by General Revenue. Phase II costs of a local demonstration project could be shared on a federal 75%-local 25% basis.

H. DEGRADED WATER QUALITY IN STREAMS, DRAINAGE CHANNELS AND NAPA RIVER DUE TO ILLEGAL DUMPING OF REFUSE

Residents abutting natural and manmade watercourses sometimes use them for disposal of refuse. This creates litter problems, requires additional public monies to clear obstructions created by the refuse and ultimately results in lowered dissolved oxygen levels. Often responsibility for dumping refuse cannot be determined because the culprit was not observed or the refuse is dispersed by streamflow.

In order to improve water quality from this standpoint, EH should continue its health oriented practice of notifying responsible property owners to remove rubbish from watercourses. Such notification is especially effective when EH has manpower available to pursue this activity and the County Counsel's office has manpower available to back the notification with the potential of legal action if the property owner refuses to cooperate.

During Phase I notification and legal backing should continue. Costs would continue to be borne by the County's General Funds.

At the commencement of Phase II, EH and the County Counsel's office should review the program to determine its effectiveness in relation to water quality in addition to its relation to good environmental health practices. Concurrently EH, the cities and the County's Flood Control and Water Conservation District should field survey the watercourses to quantify the rate and amount of illegal dumping and its effect upon water quality. Then the agencies should review their existing practices, policies and ordinances to determine if the magnitude of the problem warrants more vigorous enforcement of the existing ordinances and/or a revised or new ordinance.

If the above existing controls are deemed insufficient then the agencies should budget sufficient funds to assure that the problem is reduced and water quality is improved through such programs as education, a more vigorous enforcement of ordinances and adopting an ordinance specifically addressing this issue. Such ordinance could specify penalties such as the billing of non-cooperating property owners for refuse cleanup by public agencies.

TABLE 11 - 1

NAPA COUNTY SURFACE RUNOFF MANAGEMENT PLAN

PROBLEM	RECOMMENDED CONTROL MEASURE: POLICY	RECOMMENDED CONTROL MEASURE: ACTION	GENERAL DESCRIPTION	IMPLEMENTING AGENCY	METHOD OF FINANCING	REGULATION AND ENFORCEMENT	REMARKS
Evidence of septic tank effluent in Edgerly Island drainage ditches	Eliminate effluent at its sources	PHASE I: Determine most effective treatment technique and apply for 201 grant	Problem has been under investigation. A sewage collection and treatment facility is proposed.	County Division of Environmental Health (EH)	General Revenue	RWQCB can force abatement if facility is not constructed.	
		PHASE II: Construct facility and eliminate septic tank systems.			Section 201		
Evidence of septic tank effluent in drainage swale near Auction Yard -Tower Road Area	Eliminate effluent at its sources	On-Going. Through PHASES I & II. Locate source and require improvements. Continue surveillance	Actions are typical. They also apply to other areas which have undergone development.	County EH	General Revenue	RWQCB can force abatement if improvements are not made.	Present regulations and actions are deemed adequate to control problem.
High coliform counts in Conn Creek at Lake Hennessy.	Locate source (s). Reduce coliform populations at the source.	PHASE I: Sample Conn Creek.	Sampling to be done during 1977-78 rain season in order to locate non-point or point sources	County DPW	Redirected Surface Run-off Contract funds		
		PHASE I: Determine magnitude of problem	Control by using existing regulations.	County EH	Gen. Rev. or re-directed Surface Runoff Contract funds		
		PHASE II: Develop supplemental control program	If control of problem is not well underway at end of PHASE I, then consider additional control measures	County EH	General Revenue	RWQCB/State Health Dept. could force abatement if control measures are not implemented	
Boron values in upper Napa River sometimes exceed irrigation standards	Reduce boron values to acceptable level	PHASE I: Locate sources	Through (Upper)Napa River Baseline Water Quality Analysis -	FC & WCD	General Revenue		New wells developed to relieve Calistoga's severe water shortage may worsen problems. Controls may not be effective until drought ends
		PHASE II: Reduce discharge at sources	Through voluntary efforts and existing regulatory powers where necessary	FC & WCD, CD&PD and City of Calistoga	General Revenue	RWQCB can force abatement if controls are not effective	

Algae bloom and low DO in lower Napa River	Reduce SS & BOD in Napa River basin	PHASE I: Periodically review water quality monitoring reports	Final monitoring phase of NSD's Napa River Study Program. NSD's water quality monitoring program required by RWQCB. (Upper) Napa River Base-line Water Quality Analysis	FC & WCD	General Revenue	EPA can mandate control measures if local agencies make insufficient progress	
		PHASE I: Review existing practices for low or no cost opportunities to reduce water pollution caused by surface runoff	Revise street sweeping schedules to emphasize leaf pickups during fall and winter. Emphasize check dams and/or sed-imentation basins at construction sites. Defer seed-ing of cut & fill slopes to just prior to rain season. Encourage pasture management to reduce over-grazing. Encourage streambank protect-ion and stabiliza-tion.	All local Agencies Resource Conservation District	General Revenue		City Councils, Boards of Directors & Board of Supervisors direct applicable departments to undertake review (Napa County Resource Conservation District can provide technical assistance for rural areas)
		PHASE I: Obtain and distribute information on surface runoff control standards and options	Information would describe options such as: Criteria for grass seeding and other low cost erosion controls; rescheduling street sweeping; criteria for installing silt basin.	DPW/FC & WCD	Redirected Surface Runoff Contract funds		Obtain from EPA/ABAG and distribute to local agencies
		PHASE II: Analyze water quality monitoring reports	Determine condition and trend of water quality based up-on PHASE I sampl-ing. Determine if additional control measures are necessary	FC & WCD and RWQCB	General Revenue		
		PHASE II: Prepare and implement necessary additional control measures	Selection of control measures would be based upon mag-nitude of problems and their trends	FC & WCD and RWQCB	Planning and preparation: Gen. Revenue. Demonstration projects (if necessary): Federal/local (75%/25%) funds		Control measures to be supported by data from demonstration projects. If data not available then local demonstration project to be imple-mented.

Algae growth plus stratification in fresh water reserviors	Reduce growth and stratification where practical	PHASE I: Determine magnitude of problem	Rector, Milliken, Hennessy and Bell Canyon reservoirs. Owners continue monitoring sufficient to determine magnitude of problem and, if necessary, to determine control measures	Yountville Veterans Home and Cities of Napa and St. Helena	General Revenue		
		PHASE II: Prepare and implement necessary control measures		Yountville Veterans Home and Cities of Napa and St. Helena	Planning & Preparation: General Revenue. Demonstration projects (if necessary): Federal/local (75%-25%) funds		Control measures to be supported by data from demonstration projects. If data not available then local demonstration project to be implemented.
Degraded water quality in streams, drainage channels and Napa River due to illegal dumping of refuse	Improve water quality	PHASE I: Continue notices to property owners	Property owners responsible for illegal dumping in watercourses can be given notice to remove refuse or face court action	EH	General Revenue		
		PHASE II: Determine magnitude of problem. Determine effectiveness of existing controls	Local agencies conduct field surveys to quantify rate of dumping and its impact upon water quality. Review ordinance and existing practice.	FC & WCD, EH and cities	General Revenue		May increase manpower requirements.
		PHASE II: Implement additional controls if existing are deemed insufficient.	Revised ordinance. Increased money and manpower. Responsible property owner could be billed for cleanup by public forces.	FC & WCD, EH and cities	General Revenue		May increase manpower requirement of County Counsel's office.

TABLE 11-2

TIMETABLE

PROBLEM	ACTION	IMPLEMENTING AGENCY	PHASE I NOVEMBER, 1977 - JUNE, 1979	PHASE II JULY, 1979 - JUNE, 1983
Evidence of septic tank effluent in Edgerly Island drainage ditches	Determine most effective treatment technique and apply for 201 grant	Environmental Health		
	Construct facility and eliminate septic tank systems.	Environmental Health		
Evidence of septic tank effluent in drainage swale near Auction Yard-Tower Road area.	On-going. Through PHASES I & II. Locate source and require improvements. Continue surveillance.	Environmental Health		
High coliform counts in Conn Creek at Lake Hennessey.	Sample Conn Creek	Dept. of Public Works	March, 1978	
	Determine magnitude of problem.	Environmental Health	April, 1978	
	Develop supplemental control program.	Environmental Health		
Boron values in upper Napa River sometimes exceed irrigation standards	Locate sources	Flood Control & Water Cons. District		June, 1980
	Reduce discharge at sources	Flood Control & Water Cons. District; Conservation, Dev. & Planning Dept; City of Calistoga		July, 1980
Algae bloom and low DO in lower Napa River	Peiodically review water quality monitoring reports	Flood Control & Water Cons. District		June, 1980

TABLE 11-2 (Cont'd)

TIME TABLE

PROBLEM	ACTION	IMPLEMENTING AGENCY	PHASE I NOVEMBER, 1977 - JUNE, 1979	PHASE II JULY, 1979 - JUNE, 1983
Algae bloom and low DO in lower Napa River (continued)	Analyze water quality monitoring reports	Flood Control & Water Cons. District; Regional Water Quality Control Board		July-August, 1980
	Prepare and implement necessary additional control measures	Flood Control & Water Cons. District; Regional Water Quality Control Board		Sept, 1980-Sept, 1981
	Obtain and distribute information on surface runoff control standards and options	Dept. of Public Works; Flood Control & Water Cons. District	November-December, 1977	
	Review existing practices for low or no cost opportunities to reduce water pollution caused by surface runoff	All local agencies		
		Resource Conservation District		
Algae growth plus stratification in fresh water reservoirs	Determine magnitude of problem	Yountville Veterans' Home and Cities of Napa & St. Helena		
	Prepare and implement necessary control measures	Yountville Veterans' Home and Cities of Napa & St. Helena		
Degraded water quality in streams, drainage channels and Napa River due to illegal dumping of refuse	Continue notices to property owners	Environmental Health		
	Determine magnitude of problem. Determine effectiveness of existing controls.	Flood Control & Water Cons. District; Environmental Health and Cities		July-December, 1979
	Implement additional controls if existing are deemed insufficient.	Flood Control & Water Cons. District; Environmental Health and Cities.		January, 1980

TABLE 11-3

CONTROL MEASURES COST SUMMARY

PROBLEM	ACTION	IMPLEMENTING AGENCY	PHASE I Nov '77 - June '78		PHASE I July '78 - June '79		PHASE II
Evidence of septic tank effluent in Edgerly Island drainage ditches.	Determine most effective treatment technique and apply for 201 grant.	Environmental Health		1		1	-
	Construct facility and eliminate septic tank systems.	Environmental Health		-		-	Federal 201 and local amounts unknown at this time.
Evidence of septic tank effluent in drainage swale near Auction Yard - Tower Road area.	On-going. Through PHASES I & II. Locate source and require improvements. Continue surveillance.	Environmental Health		1		1	1
High coliform counts in Conn Creek at Lake Hennessey.	Sample Conn Creek	Dept. of Public Works	$3,500		-		-
	Determine magnitude of problem.	Environmental Health	$2,000		-		-
	Develop supplemental control program	Environmental Health					Amount depends upon extent of control measure(s).
Boron values in upper Napa River sometimes exceed irrigation standards.	Locate sources	Flood Control & Water Cons. District		$100		$100	-
	Reduce discharge at sources.	Flood Control & Water Cons. Dist; Conservation, Dev. & Planning Dept.; City of Calistoga		-		-	Amount depends upon extent of control measure(s).

1 Action to be part of general operations which are funded by general revenue.

PROBLEM	ACTION	IMPLEMENTING AGENCY	PHASE I Nov '77 - June '78		July '78 - June '79		PHASE II
Algae bloom and low DO in lower Napa River	Periodically review water quality monitoring reports	Flood Control & Water Cons. District		$100		$100	-
	Analyze water quality monitoring reports	Flood Control & Water Cons. District; Regional Water Quality Control Board		-		-	1
	Prepare and implement necessary additional control measures	Flood Control & Water Cons. District; Regional Water Quality Control Board		-		-	1 and federal funds if available
	Obtain and distribute information on surface runoff control standards and options	Dept. of Public Works; Flood Control & Water Cons. District	$500		-		-
	Review existing practices for low or no cost opportunities to reduce water pollution caused by surface runoff	City of Napa " " Yountville " " St. Helena " " Calistoga County of Napa Resource Conservation District		$1,600 700 600 700 1,500 1		$1,600 700 6 00 700 1,500 1	- 1
Algae growth plus stratification in fresh water reservoirs	Determine magnitude of problem	City of Napa " " St. Helena Yountville Vet. Home		$100 100 100		$100 100 100	-

1 Action to be part of normal agency operations which are funded by general revenue.

PROBLEM	ACTION	IMPLEMENTING AGENCY	PHASE I Nov '77 - June '78		PHASE I July '78 - June '79		PHASE II
Algae growth plus stratification in fresh water reservoirs (continued)	Prepare and implement necessary control measures	Yountville Veterans' Home and Cities of Napa & St. Helena		-		-	1 and federal funds if available
Degraded water quality in streams, drainage channels and Napa River due to illegal dumping of refuse	Continue notices to property owners	Environmental Health		1		1	-
	Determine magnitude of problem. Determine effectiveness of existing controls	Flood Control & Water Cons. District; Environmental Health and Cities		-		-	1 and federal funds if available
	Implement additional controls if existing are deemed insufficient.	Flood Control & Water Cons. District; Environmental Health and Cities.		-		-	1 and federal funds if available
		TOTALS	$6,000 (2)	$5,600 (3)		$5,600 (3)	

1 Action to be part of normal agency operations which are funded by general revenue.
2 Redirected Surface Runoff Contract Funds.
3 Estimated cost to local agencies over and above their normal operations.

12. REFERENCES

1. Gustafson, Joel F, PhD, and Carter, Ralf C, PhD, 1976. Preliminary Report, Tidal Current, Mixing and Water Quality Study. Napa Sanitation District

2. Gustafson and Carter, 1976. Marine Biological Study. Napa Sanitation District

3. Oswald, William J, PhD, and Ramani, Roy, PhD, 1974. Lower Napa River Water Quality Base Line Study. Napa Sanitation District

4. Oswald and Ramani, 1974. Water Quality in the Napa River. Napa Sanitation District

5. Frommer, Robert, MS, August, 1977. Technical Memoranda 21 and 23, Further S.F. Bay Modeling Results. ABAG

6. DiSalvo, Louis H, PhD, 1977. Draft Final Report, Environmental Effects of Dredging and Disposal in the San Francisco Bay Estuarine System. ABAG

7. Wong, Robert, 1977. Fish Kills in the San Francisco Bay: A Review. ABAG

A P P E N D I C E S

APPENDIX A
SUMMARY OF PAST STUDIES

Author	Title	Date	Area Covered By Study	Purpose of Study	Subjects Investigated	Major Findings	Comments, Significance of Study To Surface Runoff
Gustafson and Carter	Tidal Current, Mixing and Water Quality Study (Prelim Report)	May 1976	Lower Napa River	Background data for water quality monitoring	Sewage effluent stratification	Location of stratification	Tidal flushing of effluent is adequate
Gustafson and Carter	Marine Biological Study, Napa River	Feb 1976	Lower Napa River	Effect of sewage effluent upon biologic system	Benthic population. Toxicity	Sewage effluent stratified	Effect of sewage effluent discharge has slight negative effect.
Corps of Engineers	Environmental Statement, Napa River Flood Control Project	Dec 1975	Napa River in Vicinity of Napa	EIS	General environmental impact	Adverse effects outweighed by total public interest	Conflict between Napa San. Dist. water quality monitoring program and project schedule.
Corps of Engineers	General Design Memorandum and Appendicies, Napa River Flood Control Project	Sept 1975	Napa River	Flood Control	Precipitation, Runoff, hydraulic analysis and others	Justification for Flood Control project	Data on drainage in the Napa area and general basin runoff characteristics
S.F. Bay Regional Water Quality Control Board	Water Quality Control Plan Report, S.F. Bay Basin	April 1975	Bay Area	Water Quality Planning	Waste sources beneficial uses and problems	Recommended Plan	Problems, beneficial uses
Oswald and Ramani	Lower Napa River Water Quality Base Line Study	July 1974	Lower Napa River	Baseline Water Quality data. Impact of sewage effluent	Water quality parameters	Predominance of diatoms over other algeal types indicates "healthy" conditions prevail	Wide variety of water conditions

Oswald and Ramani	Water Quality in the Napa River Valley	1974	Napa River Valley	Water Quality	Waste sources, water quality parameters, potential water uses	Recommends that a five year water quality monitoring plan be initiated	Overall quality of river water is good with certain exceptions.
USGS (Rantz)	Mean Annual Runoff in the San Francisco Bay Region, 1931-70	1974	Bay Area	Water Supply	Runoff	—	General information
USGS (Goss)	Availability of Data on Surface Water Quantity and Quality, etc.	1974	Bay Area	Overview of water quantity and quality data	Briefly discusses beneficial uses and criteria	—	Reference source
Engineering Science, Inc.	Comprehensive Area-Wide Plans for Domestic Water and Sewerage Systems	June 1971	Napa River Drainage Basin	Identify facilities bearing upon water use and wastewater discharge	Existing facilities	Existing water sources must be supplemented	Imported water, groundwater or reclaimed water are potential supplements.
USGS (Rantz)	Precipitation Depth-Duration - Frequency Relations	1971	Bay Area	Water Supply Flood Control	Precipitation	—	General Information
Bureau of Sanitary Engineering State Health Department	Waste and Receiving Water Quality: Napa River	1969	Napa River	Water Quality	Discharge from sewage treatment plants	Water quality measureably improved	Bacteriological comparisons

APPENDIX B
SUMMARY OF WATER QUALITY AND QUANTITY DATA

Agency	Date	Location	Data Collected	Remarks
FC & WCD	Since 1971	Hagen Creek at Hagen Road, Napa	Discharge	During wet season only
FC & WCD	Since 1971	Lake Hennessey at boat launch ramp	Discharge	During wet season only
FC & WCD	1970-1975	27-30 stations along Napa River and tributaries at various locations	Fecal and total coliforms, temp., pH, conductivity, settleable solids, suspended solids, TDS, alkalinity, NO3, PO4, DO & BOD	Monthly grab samples at different times at different locations
USGS	1952-1966	Napa River near St. Helena (Zinfandel Gage)	Discharge, temp., conductance, turbidity, pH, chloride & DO	
USGS	Discharge since 1959 - Chemicals since 1973	Napa River at Oak Knoll Ave.	Discharge, CA, NA, HCO3, CACO3, chloride, DS, hardness, conductance, pH, temp., turbidity, DO, CO2 & B	Monthly grab samples
Napa Sanitation District	1970-1974	Lower Napa River (5 stations)	Total coliforms, temp., pH, conductivity, solids, TDS, alkalinity, NO3, PO4, DO, BOD & algae	
FC & WCD and USGS	Since 1975	10 stations along Napa River and tributaries	Coliforms, pH, TDS, DO, BOD, conductivity and others	Napa River Baseline Water Quality Study

APPENDIX C

MAC MODEL INPUTS

UPPER NAPA RIVER SUB-AREA A

	Area Acres	K Factor	BOD	SS	VSS	TOT N	TOT P
Residential	187.	.30	15.	100.	25.	1.50	.40
Commercial	0.	.30	20.	150.	70.	5.	.70
Industrial	5.	.30	13.	120.	50.	3.	.50
Open	52148.	.20	3.	150.	25.	1.25	.10
Agriculture	1000.	.20	6.	350.	50.	3.50	.80

UPPER NAPA RIVER SUB-AREA B

	Area Acres	K Factor	BOD	SS	VSS	TOT N	TOT P
Residential	428.	.30	15.	100.	25.	1.50	.40
Commercial	26.	.30	20.	150.	70.	5.	.70
Industrial	36.	.30	13.	120.	50.	3.	.50
Open	1100.	.20	3.	150.	25.	1.25	.10
Agriculture	10714.	.20	6.	350.	50.	3.50	.80

UPPER NAPA RIVER SUB-AREA C

	Area Acres	K Factor	BOD	SS	VSS	TOT N	TOT P
Residential	900.	.35	15.	100.	25.	1.50	.40
Commercial	128.	.50	20.	150.	70.	5.	.70
Industrial	52.	.50	13.	120.	50.	3.	.50
Open	920.	.20	3.	150.	25.	1.25	.10
Agriculture	0.	.20	6.	350.	50.	3.50	.80

	Area Acres	K Factor	BOD	SS	VSS	TOT N	TOT P
MIDDLE NAPA RIVER SUB-AREA A							
Residential	685.	.30	15.	100	25	1.50	.40
Commercial	104.	.30	20.	150	70	5	.70
Industrial	5.	.30	13.	120	50	3	.50
Open	75210.	.20	3.	150	25	1.25	.10
Agriculture	2500.	.20	6.	350	50	3.50	.80
MIDDLE NAPA RIVER SUB-AREA B							
Residential	1880.	.30	15.	100	25	1.50	.40
Commercial	20.	.30	20.	150	70	5	.70
Industrial	310.	.30	13.	120	50	3	.50
Open	4239.	.20	3.	150	25	1.25	.10
Agriculture	28440.	.20	6.	350	50	3.50	.80
MIDDLE NAPA RIVER SUB-AREA C							
Residential	6340.	.35	15.	100	25	1.50	.40
Commercial	410.	.70	20.	150	70	5	.70
Industrial	250.	.50	13.	120	50	3	.50
Open	2935.	.20	3.	150	25	1.25	.10
Agriculture	0.	.20	6.	350	50	3.50	.80

	Area Acres	K FACTOR	BOD	SS	VSS	TOT N	TOT P
AMERCIAN CANYON SUB-AREA A							
Residential	54.	.30	15	100	25	1.50	.40
Commercial	0.	.30	20	150	70	5	.70
Industrial	4.	.30	13	120	50	3	.50
Open	13065.	.20	3	150	25	1.25	.10
Agriculture	18000.	.20	6	350	50	3.50	.80
AMERICAN CANYON SUB-AREA B							
Residential	58.	.30	15	100	25	1.50	.40
Commercial	20.	.30	20	150	70	5	.70
Industrial	25.	.30	13	120	50	3	.50
Open	1000.	.20	3	150	25	1.25	.10
Agriculture	10863.	.20	6	350	50	3.50	.80
AMERICAN CANYON SUB-AREA C							
Residential	301.	.40	15	100	25	1.50	.40
Commercial	40.	.30	20	150	70	5	.70
Industrial	100.	.30	13	120	50	3	.50
Open	428.	.20	3	150	25	1.25	.10
Agriculture	0.	.20	6	350	50	3.50	.80

	Area Acres	K Factor	BOD	SS	VSS	TOT N	TOT P
WOODEN VALLEY SUB-AREA A							
Residential	25.	.30	15	100	25	1.50	.40
Commercial	1.	30	20	150	70	5	.70
Industrial	0.	.30	13	120	50	3	.50
Open	26201.	.20	3	150	25	1.25	.10
Agriculture	2200.	.20	6	350	50	3.50	.80
WOODEN VALLEY SUB-AREA B							
Residential	49.	.30	15	100	25	1.50	.40
Commercial	0.	.30	20	150	70	5	.70
Industrial	0.	.30	13	120	50	3	.50
Open	194.	.20	3	150	25	1.25	.10
Agriculture	2600.	.20	6	350	50	3.50	.80

EMP DEVELOPMENT AND APPROVAL SCHEDULE
(By ABAG Staff, Aug 31 '77)

1. Draft Environmental Management Plans Available

   Summary of Plans . . . . September 7, 1977
   Individual Elements:
     Water Quality, Water Conservation, and Solid
       Waste . . . . September 30, 1977
     Air Quality . . . . October 14, 1977

   Drafts will be sent to local government elected officials and staff with request for comment by November 15. Comments by that date will be reported, answered, and reflected when possible in December 15 Draft Environmental Management Plan. Briefings will be held for local government delegates and officials.

2. Individual County Proposed Surface Runoff Plans Available . . . . October 12, 1977

3. Draft Integrated Environmental Management Plan Available (Includes air, water and solid waste plans). . . . . December 12, 1977

   Drafts will be sent to local governments with request for comment by January 20. Comments will be reported and answered in a report to the February 8 General Assembly. Briefings for local officials will continue.

4. EMTF Hearings Schedule. . . . . . . January 11, 1978 - Hotel Claremont
   January 25, 1978 - N. Bay Site
   February 14, 1978 - S. Bay Site

5. ABAG General Assembly for Plan Review . . . . February 8, 1978
   Hotel Claremont

6. EMTF Final Hearing and Approval . . . . February 22, 1978
   Hotel Claremont

7. ABAG Regional Planning Committee Approval . . . . . March 1, 1978
   Hotel Claremont

8. ABAG Executive Board Approval . . . . March 16, 1978
   Hotel Claremont

   Briefings for local officials on proposed final language of the plan.

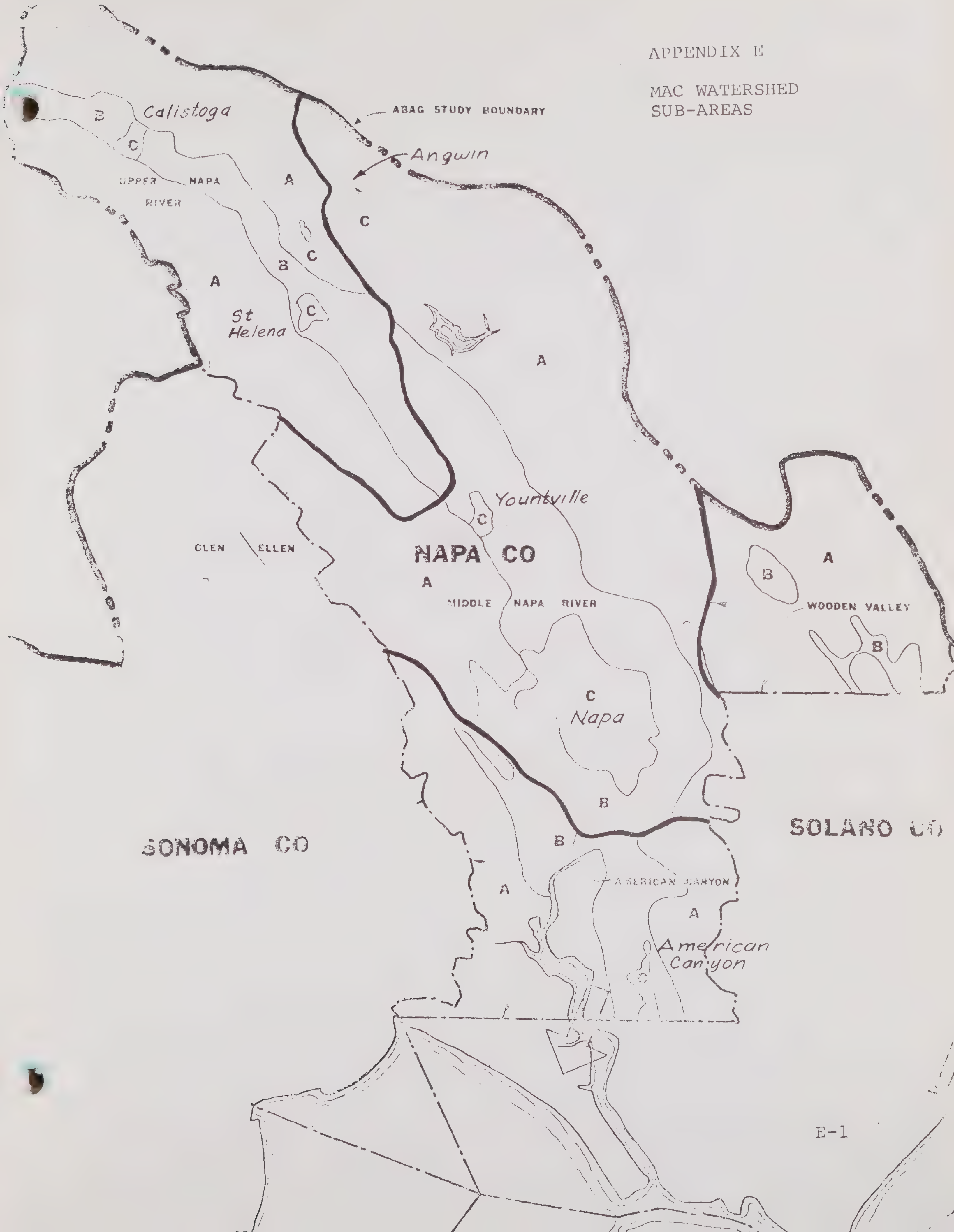
9. ABAG General Assembly Approval . . . . April 6, 1978
   San Jose

10. State and Federal Approvals . . . . May through October 1978

   State agency hearings to be scheduled.
   State Water Resources Control Board certification required by June 21, 1978.
   EPA Regional Administrator accepts by October 19, 1978.

APPENDIX E

MAC WATERSHED SUB-AREAS



FINAL DRAFT

SAN MATEO COUNTY SURFACE RUNOFF MANAGEMENT PLAN

(A Portion of the Bay Area 208 Environmental Management Program)

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PLANNING DIVISION • COUNTY OF SAN MATEO • SEPT., 1977

ACKNOWLEDGMENTS

The San Mateo County Surface Runoff Management Plan was prepared under the guidance and assistance of the following:

The 208 Steering Committee

Regular Members:

City of Belmont	James P. DeChaine
City of Foster City	John Donlevey, Richard Hopper
City of Millbrae	Bill Huston
City of Pacifica	Don Weidner
City of Redwood City	Dick Pusich
City of San Carlos	C. R. Allen, Malcolm Byce
City of San Mateo	Elmer Schaal
East Palo Alto Municipal Council	Barbara Mouton
City of South San Francisco	Frank Addiego
County of San Mateo:	
County Manager's Office	Max Meyer
Environmental Health Office	Henry Eich, Rex Goff
Environmental Management (Director)	Allan Colman
Environmental Management (Planning Div)	Donald A. Woolfe, Bill Powers, David Hale
Public Works	Sid Cantwell, Vic Sanders, Neil Cullen

Advisory Members:

San Mateo County Resource Conservation District	Don Louviere
San Mateo Mosquito Abatement District	Charles Dill
Other San Mateo County Cities and Districts	
Environmental Management Task Force Liaison Committee	Fred Lyon, Bill Hardwick, Paul Reimer, Mary Henderson, Jacquie Darracott, Chet Holcomb

The San Mateo County Regional Planning Committee

Regular Members:

Malcolm Dudley, Atherton	Janice Fulford, Pacifica
William Hardwick, Belmont	Eleanor Boushey, Portola Valley
Anja Miller, Brisbane	Michael Barrett, Redwood City
R. David Martin, Burlingame	Anthony Governale, San Bruno
Raymond Ottoboni, Colma	James Kilburg, San Carlos
McRobert Stewart, Daly City	Jane Baker, San Mateo
Henry Anthony, East Palo Alto	Fred Lyon, San Mateo County
Kiyoshi Matsuo, Foster City	Roberta Taglia, So. San Francisco
Ira Bonde, Menlo Park	Joan Stiff, Woodside

Public Members:

Aaron Jackson, Chairman	Sanford Friedman
Edward French	George Feliz
Charles Hasty	William E. Lawrence

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PBQ&D, Inc., engineering consultants	Brian Van Weele, Don Salle
San Mateo County Planning Staff	Barry Nathan, Bernie Burton, Joel Panzer, Lon Warneke, Denise Voll

Other Regional, State, Federal Agencies:

Regional Water Quality Control Board	Allan Thompson, Griff Johnston
California Dept. of Fish & Game	Keith Anderson
U.S. Environmental Protection Agency	Harry Seraydarian
Association of Bay Area Governments	Surface Runoff Management Staff
Project Manager	Geri M. Farman, 208 Coordinator

FINAL DRAFT

SAN MATEO COUNTY SURFACE RUNOFF MANAGEMENT PLAN

(A Portion of the Bay Area 208 Environmental Management Program)

The preparation of this report, was financed in part through an area-wide waste treatment management planning grant from the Environmental Protection Agency, Region IX, under the provisions of Section 208 of the Federal Water Pollution Control Act as amended.

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

PLANNING DIVISION • COUNTY OF SAN MATEO • SEPT., 1977

TABLE OF CONTENTS

TABLES AND FIGURES

I

INITIAL PLAN SUMMARY

In November 1976, San Mateo County agreed to prepare a surface runoff management plan. A similar effort has been undertaken by other Bay Area counties. These County plans will be only one part of a seven plan Environmental Management Program for the Bay Area which is designed to meet the National Water Pollution Control Act, Section 208 (1972) and the Clean Air Act (1970). Funding for this extensive planning effort was provided by the federal Environmental Protection Agency and overall administration is being provided by the Association of Bay Area Governments (ABAG).

In San Mateo County, the Runoff Plan has been prepared by Planning staff with technical assistance provided by PBQ&D, and policy direction and public participation provided by a local 208 Steering Committee and San Mateo County Regional Planning Committee (RPC). These groups, composed of public officials, county, city and district staff, and the public, developed planning goals, objectives, strategies, and control measure alternatives. (See Appendix A for basic planning documents)

The goal for the San Mateo County Runoff Plan has been to develop a reasonable management plan agreeable to local communities to maintain or improve surface water quality in and around San Mateo County.

Surface water quality can be affected by many possible pollution sources. In recent years, sewage treatment has received the highest priority nationwide and in the Bay Area as a pollution source. As this source is being controlled, surface runoff has been receiving increasing attention.

Surface runoff is the water that washes over lands before entering our streams, the Bay or Ocean. While it can provide many benefits to these receiving waters, it can also be the carrier of waste products of our cities and rural areas. The sources and types of these wastes can be widely dispersed and are often referred to as "nonpoint." Runoff can carry fallout from vehicles (lead, oil, brake linings), debris, silt, bacteria, nutrients and pesticides. These materials can serve to minimize the many beneficial uses of water. (See Glossary, Appendix D)

Each Bay Area county initiated a study to determine the possible local or regional effects of runoff. The initial study effort in San Mateo County indicates that surface runoff by itself is probably not a major problem for environmental quality. The major drinking water reservoir, Crystal Springs, has been protected from development, and all bathing waters in the County are open to swimming. However, this initial study, which is summarized in Appendix B, does indicate some areas of concern.

There are some water quality problems in this County which may be aggravated by surface runoff, and there are potential sources of

pollution (debris, vehicle wastes, erosion) which could be carried by stormwater into local streams, the Bay, or the Ocean. These sources and locations of possible runoff related problems are indicated on Table 1 and Figure 1.

For the purpose of this initial planning effort these problems serve as working priorities. Because the cause and effect relationships of surface runoff pollution are not well understood, these priorities should be considered a flexible tool for planning purposes. Identification of regional priorities and further local study may indicate needed changes in these priorities.

The initial study effort has also shown that runoff is often associated with other problems which may be even more important to people in this County. The dumping and littering which contribute to runoff problems can also contribute to problems with drainage, flooding, mosquitos, rats and general aesthetics. There are many local programs which are designed to control these problems which also benefit runoff quality. The initial study effort has documented several of these local programs, (see tables 12, 13, & 14) and has found that the level of operations for such services as street sweeping is very high in this County. The effectiveness of such clean-up services for water quality, however, is not well understood.

A major conclusion of the study is that present information about surface runoff-related problems and effective control measures is too ambiguous to justify extensive new programs. Instead, the County's Runoff Plan emphasizes a low-cost approach to enhancing the water quality benefit of existing programs, and developing some additional programs which have multiple benefits for local communities by solving the types of related problems mentioned above. Further problem identification and control measure assessment are recommended as the basis for future planning.

This Plan is considered an initial plan which will change and develop through a continuing planning effort. This Initial Plan provides a very specific first year work program and a general plan for what will be done for five years. Control measure activities will be phased over this time period.

For purposes of this Initial Plan, the first year program, "Year One," covers the period from August 31, 1977 to June, 1979. This longer Year One time period is necessary because the Bay Area's Environmental Management Plan cannot be officially approved by State and federal officials until June, 1978 at the earliest. There are some actions, however, which can be initiated in the interim period. Remaining County 208 grant funds are available through June, 1978 to help lay the foundation for local program efforts.

TABLE 1

SUMMARY LIST OF PROBLEMS FOR INITIAL PLAN*

1. Known water quality problems thought to be impacted by nonpoint sources.

<u>Bayside</u>

Lagoons
Coyote Point shellfish beds

<u>Coastside</u>

San Pedro Creek
Frenchman's Creek
Pillar Point and Martin's Beach shellfish beds

2) Potential nonpoint pollution sources identified in this initial study effort as <u>widespread</u> or <u>possibly</u> present in waters at marginal or unacceptable concentrations:

Debris and litter**

Erosion or siltation

Oil and lead**

Infiltration and sewer failures

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* See Section II. A, Problem Priorities, and Appendix B, <u>Study Methodology and Findings</u> for further description of these problems and how they were determined.

** For purposes of this Plan, these two categories are combined and referred to as Debris and Vehicle Wastes.

FIGURE 1 KNOWN WATER QUALITY PROBLEMS IN SAN MATEO COUNTY

Key to Figure 1

Bayside Water Quality Problems

B.1. Brisbane Lagoon: Algae, weeds, siltation, stagnant water, and oil or grease noted in the survey of local public officials.

B.2. Airport: Some oil in nearby waters noted in public participation process.

B.3. San Mateo Wastewater Outfall: Total coliform organisms noted in the receiving waters as reported to the Regional Water Quality Control Board (April 1977). Major plant improvements presently being completed to correct problems. County Health Department bacteriological samples in the vicinity of the outfall are regularly very low (approximately 45 MPN/1--ml).

B.4. Marina Lagoon: Algae, stagnant water, odor, bacteria, and fish problems noted in local survey of public officials.

B.5. Foster City Lagoon System: Algae blooms, weeds, stagnant water, grease, oil, bacteria, and fish problems noted in the survey of local public officials. A Lagoon System Managment Plan is presently being updated, and major capital improvements are underway to help meet NPDES permit requirements and improve beneficial uses of this system.

B.6. Marine World: Fish kill in receiving waters noted by California Fish and Game in the past year, due to improper pesticide usage. Some problems with pH noted in receiving waters in reports to the Regional Water Quality Control Board. Discharge from the area, presently controlled by an NPDES permit, becomes part of the intake water for Marina Lagoon.

B.7. Redwood Shores Lagoon System: Some problems with stagnant water and algae bloom noted in local survey.

B.8. Shoreway Road Area: Oil, grease, and other contaminants noted in reports to the Regional Water Quality Control Board (1977) in the flood control zones near Shoreway Road.

B.9. San Francisquito Creek: Occasional problems in the past with trout or stickleback kills (noted by the County Health Department and California Fish and Game), attributed primarily to reduced flows in summer.

B.10. Coyote Point Shellfish Beds. Small beds which are situated near drains and may either be beneficial or adversely impacted by storm drainage.

Coastside Water Quality Problems

C.1. San Pedro Creek: California Fish and Game cites area as highest priority problem in San Mateo County, noting an annual fish kill of juvenile steelhead trout and resident fish (sculpen, stickleback). Problem attributed by Fish and Game to urban drainage and dumping (from shopping center), aggravated in the summer and throughout the present drought by low flows. Other problems noted in the local survey include siltation, stagnant water, bacteria, and sewer system problems. Nearby shellfish beds may be affected.

C.2. Pillar Point Harbor Beach: Some siltation and oil noted in local survey may affect nearby shellfish beds.

C.3. Frenchman's Creek: Some siltation and algae noted in local survey. California Fish and Game notes area as second highest priority for San Mateo County. There are no records as yet of fish kills, but drainage from a major horse stable flows directly into the creek with possible adverse effects.

C.4. Martin's Beach: Some algae problems noted in local survey. Runoff from Lobitos Creek may affect nearby shellfish beds.

C.5. Pescadero Marsh: Some stagnant water problems noted by Fish and Game, attributed primarily to low flows and water diversion rather than surface runoff.

C.6. Pescadero Groundwater: Bacteria and high nitrate levels found in local groundwater and attributable primarily to septic tanks.

The Runoff Plan will be updated annually to determine a new annual work program and a new five-year planning framework. This update will rely on further problem identification, control measure assessment, and any needed changes in local or regional priorities. Recommendations for the Initial San Mateo County Plan are grouped into two categories: specific control measure actions designed to address potential sources of runoff pollution; and general planning activities designed to provide a framework for more site-specific problem identification, control measures, and continuing planning. These activities are summarized briefly below and in Tables 2, 3, 6 and 7.

Those actions which are recommended for Year One are discussed in detail in this report in Section II.D. The detail on each Year One program, includes a very specific work program schedule, and assessment of costs as well as environmental, social, institutional and financial impacts. General milestones for actions beyond Year One are provided in Table 6. These milestones will be reviewed and modified annually to reflect needed changes.

The County's Draft Surface Runoff Plan will be reviewed by San Mateo County jurisdictions and the public during August and September, 1977. In October, the Draft Plan will be transmitted to ABAG. At the regional level, concern will be for the overall runoff problem of eight counties in the Bay Area. To assure some regional perspective on this potential problem, the eight Bay Area county runoff plans will be integrated into a regional surface runoff plan between October and December 1977. A consolidated Environmental Management Plan which combines the regional runoff plan and the six other environmental plans will then be reviewed and approved by the Environmental Management Task Force (EMTF), ABAG General Assembly, and State and federal governments.

Enforcement of the Runoff Plan may eventually be the responsibility of the Regional Water Quality Control Board. Under proposed regulations by the Environmental Protection Agency, permits may be issued to areas for stormwater discharge. (See Appendix A for these proposed regulations). These areas could be as large as the Bay Area or could be granted to areas such as counties which have an established management plan. Permits would probably be unconditional for the first few years, but could be made conditional depending on the degree of local compliance with the 208 program. Recommendations on this permit process will be developed as a part of the integrated County Runoff Plans.

1. Specific Control Measure Activities

Specific recommendations are provided for each potential problem source identified as a priority for this Initial Plan.

Primary emphasis in the Plan has been placed on measures which can minimize accumulations of debris and vehicle wastes (crankcase

oil, lead) on streets, storm inlets, channels and streams.

The Plan recommends more clearly identifying specific areas where these accumulations are persistent. In addition, it recommends emphasis on a prevention program. This program would consist of public education, model litter and dumping controls for local jurisdictions, and an oil recycling program. A program to improve the water quality benefit of existing agency clean-up programs (stormdrains, street sweeping) is also outlined.

Some of the vehicle wastes are a product of vehicle design standards which do not take possible surface runoff pollution into consideration. For this reason the Plan recommends that industry and government encourage design and maintenance standards to protect water resources. The focus would be on oil leaks, exhaust (lead) and brake linings (asbestos).

Erosion and resulting siltation are problems associated primarily with activities which disturb the soil (construction, agriculture, and increased runoff or stream flow).

The initial study indicates that these problems could be greatest on the Coastside of the County since the Bayside is largely urbanized. The Plan recommends pinpointing specific areas of significant erosion, and initiating a detailed analysis of County erosion and runoff control policies, particularly in the Coastal area. This effort would be part of the current Coastal Planning Program. Recommendations on management, new techniques and implementation would be made and an implementation program established. The feasibility of a streamside protection ordinance will also be explored. Many of these findings could then be utilized by other jurisdictions as a model for similar improvements.

The Plan also supports current County efforts to modify road design standards. These new standards could serve to minimize surface runoff. Additionally, a special area study of the Guadalupe Valley watershed will be initiated which will lead to recommendations to minimize siltation into the Brisbane Lagoon.

Many jurisdictions in San Mateo County have significant sanitary sewer line infiltration during storms. This infiltration can lead to sewer line failures and resulting spillage of sewage into drainageways. While many local jurisdictions have had special federally-funded studies to locate areas of infiltration, others which have a need are considered low priority for such assistance. The Plan recommends continued federal and State aid for infiltration analysis and for sewer line repairs and replacement.

The Plan recommends that special water quality problems be addressed through the coordinated efforts of local agencies. In

some cases more detailed survey or monitoring work will be needed to serve as the basis for appropriate control measures. In other cases appropriate control measures will be easier to determine. A specific work program for these efforts is recommended in the Plan.

2. General Planning Activities

The Initial Plan provides recommendations on three general planning activities: further problem identification and control measure assessment, continuing planning, and documentation of local practices.

o Further Problem Identification and Control Measure Assessment. The Plan recommends that further problem identification and control measure assessment be accomplished through the coordinated efforts of existing agencies. A technical subcommittee of the 208 Steering Committee is proposed which would develop coordinated record keeping, field work, monitoring, and control measure design and analysis for the priority problems identified in this Plan. Specific first year work program alternatives are proposed for review and possible adoption by such a subcommittee in November, 1977. Emphasis in this proposal is on coordinated field surveys for hazardous discharges, debris, and sewer line malfunctions; pinpointing significant erosion sites on the Coast; continued monitoring of shellfish areas with some modifications; and developing specific recommendations for solving known problems. One example of such specific recommendations is the public education effort for the lagoon areas to be conducted in the first year. This effort will help assess the effectiveness of education as a control measure as well as benefit a specific problem area. Another example is the Frenchman's Creek area which can be monitored above and below the suspected problem source to determine whether specific remedial actions are needed.

  It should be noted that increased monitoring of storm water discharges may be necessary in the future under proposed EPA regulations. The type of problem-focused coordinated agency approach outlined here may provide an alternative to such monitoring. More useful information about a particular water quality problem can be developed by cooperative field work in a particular watershed than end-of-the-pipe monitoring in numerous locations.

  The Plan also recommends continued federal or State funded research and monitoring to determine control measure effectiveness and to help identify problems.

- Continuing Planning. For this initial planning effort, the San Mateo County Planning Division has acted as lead agency. This status is expected to continue through June, 1978, at which time the County's agreement with ABAG officially terminates. A determination of who will be responsible for coordinating an annual review and update of the Plan and assisting with plan implementation after that time must be made.

  The Plan recommends a combination of two basic options: one single lead agency and a 208 Steering Committee to guide continuing planning efforts. This option would require local cost-sharing to offset the additional lead agency expenditures. Each jurisdiction would be asked to contribute approximately $200 to a lead agency the first year, and to provide staff time for attending meetings directed to continued coordination and implementation of the Plan.

  There are several options for the selection of a lead agency. A process and schedule for this selection is provided to assure a transition by June, 1978. The Plan recommends that the County Planning Division assume this role.

  The Plan recommends that Federal funds be provided for continuing planning to help offset local costs beyond Year One. Year One efforts are supplemented, at least through June, 1978, by remaining 208 funds. An interim plan update is recommended for June which may identify other sources of available funding.

- Documenting Local Runoff Practices. An important part of the initial study has been identifying existing practices and projects which help control surface runoff pollution. An adequate description of all related activities would almost be a compendium of urban and rural public works and planning services. The Plan indicates some of the findings on street sweeping, storm inlet/catch basin cleaning, and drainage channel/stream cleaning.

  The Plan recommends that continued documentation be directed to providing information on the most effective elements of local practices or projects. This information on local "best management" practices can then be used to develop model approaches for use by others. A worksheet is provided in the Plan for this type of focused documentation. The worksheet is designed to provide information for the first year program, and would be rewritten for each annual plan update. This worksheet would also be used to document other agency actions which help to implement the Plan.

Table 2 Summary of Year One Program Costs
October, 1977 to June, 1979*

Funding Sources

Recommendations	Total Cost*	Brisbane	Foster City	Half Moon Bay	Pacifica	Redwood City	San Mateo	All Cities (19)	Cities on Steering Committee (4)	County	Resource Conser-vation District	Mosquito Abatement District	208 Planning Grant	Other
A.1. Problem Identification	See E, below													
A.3. (b) Local Pilot Education Program	$14,244	$5,840	$384			$384	$384			$768		$384	$5,720	ABAG: $380
(b) Regional Pilot Education Program	$57,338	$ 48	$ 48-$3,535 (optional)			$ 48-$3,535 (optional)	$ 48-$3,535 (optional)			0-$3,535 (optional)			$ 380	Proposed EPA Grant: $42,433 ABAG: $190 - $14,333
(c) Model Litter & Dumping Controls	$ 6,988							$192@	$96@	$1,152	$288	$288	$1,236	
(d) Model Oil Recycling	$ 7,210							$ 96@		$ 384	$ 96	$ 96	$4,810	
(e) Develop Program	Included in A.3 b),c),c)													
A.5 Improve Street sweeping	$ 7,800							$144@+		$ 144+			$4,920	
B.1 Problem Identification	See E. below													
B.2 (a) Co. Coastal Study	$16,168			$144	$144					$ 720+	$144		$15,016	Local Coastal Program Grant
(b) Area Plan	$35,000									$35,000				
C.2 Problem Identification	See E,below													

*This summary includes the Year One costs for those recommendations which will be initiated or completed during that time period. Local costs are primarily for meetings, documenting practices, continuing planning and problem identification. Costs for implementing new or modified public services in local communities are not included in this Table. These costs were developed using cost assumptions shown on Table 8 and detailed cost estimates found in Section II.D.

Table 2 Cont. Summary of Year One Program Costs
October, 1977 to June, 1979*

Recommendations	Total Cost	Funding Sources: Brisbane	Foster City	Half Moon Bay	Pacifica	Redwood City	San Mateo	All Cities (19)	Cities on Steering Committee (4)	County	Resource Conservation District	Mosquito Abatement District	208 Planning Grant	Other
D.1 (a) & (b) County Monitoring	Part of Continuing Program													
(c) San Pedro Creek Study	See E, below													
D.2 (a) Lagoon Programs	See A.3 (b), B.2(b)													
(b) Foster City Lagoon Management Plan			Part of continuing Program											
(c) New programs	See E, below													
E.1 Problem & Control Measure Assessment	$19,208							$192@		$768	$192	$192	$13,064	7 other agencies (see Table 10): $192@ or $1,344
F.1 Establish Procedures for annual update	$ 7,278							$192@		$768	$192	$192	$ 2,478	
F.2 Establish Lead Agency	Included on F.1													
F.3 Financing Mechanisms: Interim Update (June, 1978)	Interim $8,160							$ 96@	$96@	$768	$192	$192	Interim $4,800	
Annual Update (June, 1979)	Interim $8,160							$288@	$96@	$1,536	$384	$384	-0-	Outside Assistance will be sought
G.1 Documenting Local Practices	Included in all of the above													
	$107,314	$5,888+	$432 - $3,967	$144	$144	$ $432 $3,967	$432 - $3,967	$1,200@ or $22,800	$288@ or $1,152	$42,003 $45,543	$1,488	$1,728	$52,242	See Above

*This summary includes the Year One costs for those recommendations which will be initiated or completed during that time period. Local costs are primarily for meetings, documenting practicies, continuing planning and problem identification. Costs for implementing new or modified public services in local communities are not included in this Table. These costs were developed using cost assumptions shown on Table 8 and detailed cost estimates found in Section II.D.

Table 3 Estimated Costs for Years Two to Five*

	TOTAL COST	CITIES (19)	COUNTY (INCLUDES LEAD AGENCY COSTS)	RESOURCE CONSERVATION DISTRICT	MOSQUITO ABATEMENT DISTRICT	OTHER	COMMENTS
ANNUAL COSTS							
. Recommendation E.1: Further Problem Indentification and Control Measure Assessment.	Approximately $20,000 per year for continued agency coordination and special studies.	$548 ea./yr	$4656 per year	$548 per year	$548 each year	$548 each for 7 other agencies each year, See Table.	Outside funding will be sought
. Recommendation F.3: Annual review and update.	Approximately $8160 per year	$288 each per year (Additional costs for 208 Steering Committee members)	$1152 per year	$384 per year	$384 per year		
. Recommendation G.1: Documenting Local Practices.	Included in F.3, above.						
. TOTAL	$28,160	$1,436 each per year	$5808 per year	$932 per year	$932 per year	See Above	
ADDITIONAL COSTS							
. Recommendation A.4: Develop and Implement model stormwater system cleaning.	Approximately $7,800 for developing model approaches. Implementation costs unknown.	$312 each per year	$1248	#312	$312		
. Recommendation B.3: Model Road design criteria	Approximately $6,700	$294 each	$884	$294	-0-		Considerable funds have already been spent by the County. Funds shown here would be primarily for coordination with other County agencies and disseminating the County's findings.
. TOTAL	$14,500	$606 each	$2,132	$606	$312		

* This Table includes only those annual or special costs for continued planning efforts and identifed additional studies. It does not include possible additional special area studies except those included in Item E. Costs of implementing model approaches to runoff control or of continuing the many existing local programs is not included here.

II

INITIAL PLAN

A. PROBLEM PRIORITIES

Priorities are needed in the Initial Plan to guide plan development and to provide a structure for continued planning.

At this time, regional priorities for surface runoff-related problems have not been identified. If they are established, they will probably be a composite of locally-identified priorities in each of the eight county plans. The recommended planning approach for San Mateo County calls for considering such priorities within the context of the continuing planning process.

Present information about runoff problems in San Mateo County is very limited, and it is not possible to develop a firm list of County priorities. Nevertheless, some working priorities for control measure actions can be identified for this Initial Plan. These priorities should be reassessed annually to reflect the results of further problem identification. Working priorities for the plan are based on two general types of problems:

1. Known water quality problems which may be impacted by surface runoff or nonpoint sources. Most of these problem areas are relatively minor in scope and severity. Surface runoff is suspected to be a contributing factor to water quality problems, but the cause and effect relationships are not well defined.

2. Potential nonpoint pollution sources identified in this initial study effort as widespread or possibly present in waters at marginal or unacceptable concentrations. The precise locations and severity of many of these possible pollution sources is not well known, but it is suspected that they can contribute to water quality problems.

   The "problems" which meet these criteria are indicated on Tables 4 and 5, and Figure 1. The study effort which suports these findings is summarized in Appendix B.

It should be emphasized that many of these "problems" are highly interrelated, and that this priority list should be considered a flexible tool for planning purposes. For example, while biochemical oxygen demand (BOD), nitrogen, and phosphorus do not appear to be causing significant overall problems in County waters, they probably contribute to the Bayside lagoons' algae situation and therefore may need to be addressed in dealing with a site-specific problem.

Table 4 "Problems" which meet Criteria #1 for Establishing Initial Plan Priorities: Known water quality problems which may be impacted by nonpoint sources.

Criteria #1 / Areas with some observed water quality problems (See Fig. 1)	Areas where Nonpoint Sources May Contribute to Observed Problems on a Regular Basis.	Comments on Possible Nonpoint Contributions
Bayside		
1. Brisbane Lagoon	X	Nutrients (algae), erosion, oil, and grease
2. San Mateo Wastewater Outfall	--	
3. Marina Lagoon	X	Nutrients (algae), debris, and oil
4. Foster City Lagoon	X	Nutrients (algae), debris, and oil
5. Marine World	Possible, but not likely	Fish kill in receiving water due to possible isolated case of improper pesticide use; may not be a continuing problem.
6. Redwood Shores Lagoon	X	Debris and oil, some nutrients (algae)
7. Shoreway Road area	Possible, but not likely	Oil and grease noted by Regional Board. Clean-up required.
8. San Francisquito Creek	--	
9. Shellfish beds	*Possible, but little documentation	The small beds near Coyote Point may be affected by storm drainage.
Coastside		
1. San Pedro Creek	X	Oil, debris, unknown discharges noted by California Fish and Game: their highest priority problem in the County. Some siltation and algae noted in local survey.
2. Pillar Point Harbor beach and shellfish beds	*Possible, but little documentation	Some siltation and oil noted in local survey.
3. Frenchman's Creek	X	Drainage from horse stable noted by California Fish and Game: their second highest priority problem in County. Some siltation noted in the survey.
4. Martin's Beach and adjoining shellfish beds	*Possible, but little documentation	Some algae noted in survey.
5. Pescadero Marsh		
6. Pescadero Groundwater		

*Drainage from creeks and storm drains could be resulting in both positive (nutrients, silt) and negative (bacteria, heavy metals) impacts.

Table 5 . "Problems" which meet Criteria #2 for Establishing Initial Plan Priorities: Potential pollution sources identfied as widespread or possibly in water at marginal or unacceptable concentrations.

Criteria #2 / Potential Non Point Pollution Source	Presence widespread in all or major areas of the County	Modeling or Monitoring Results Indicate Marginal or Unacceptable Concentrations
Debris, litter on streets, and in stormwater system	XX	--
Erosion or siltation	X	X
Oil and Lead	X	XX
Bacterial Contaminants	X	--
Phosphorus, Nitrogen, BOD	--	--
Fertilizers	--	--
Infiltration/Sewer Failure	X	--

See Appendix B of this report for discussion of the problems listed here.

XX - Indicates that almost every jurisdiction noted some problem in the local survey, or that modeling results indicated possibly unacceptable concentrations of material. (See Appendix B, Table B-3)

X - Indicates that many jurisdictions noted some problems in local survey, or that modeling indicates marginal concentrations of material.

B. SCREENING CONTROL MEASURES

Control measures are activities which help in the short or long term to reduce the potential impact of surface runoff on receiving waters. Specific control measure activities for San Mateo County were developed utilizing a screening processs for the five-year program which is described here. Activities were selected based largely on whether they build on existing practices, projects or interests, whether there are multiple benefits for local communities or agencies, and whether there could be possible widespread application. Cost of these activities was controlled by concentrating on nonstructural controls, education about prevention and best management practices, and cooperative actions among local agencies to implement best management practices.

Several source lists of control measures were used in this screening process. These are included in Appendix C along with a series of charts which summarize the screening rationale. The source lists included a manual provided by ABAG, and other ideas developed by local public officials, the Regional Planning Committee and the public.

The screening process concentrates on the ABAG list because all counties were required to assess these for local applicability. This list contains broad categories of measures which encompass most of the local ideas. For each of the priority problems identified in the Plan, a list of candidate control measures was prepared along with a discussion of the criteria for selection and final recommendations for the Initial Plan.

Several of the recommended control measures call for developing and implementing model approaches to existing public services. These model approaches will be developed using local agency experience and will reflect needed variations within the County. Different approaches may be needed for improved and unimproved areas, and the Coast and Bay sides of the County.

C. THE FIVE YEAR PROGRAM

A five year surface runoff management program, which covers the period October, 1977 to June, 1983, is presented in this Initial Plan. The Plan addresses the priority problems identified to date. It includes specific control measure activities for these problems, as well as a general planning program designed to promote continuing planning and implementation.

The five year program includes a very detailed work program for Year One, and a more general plan for years two to five. These activities, and a time schedule for their implementation are indicated on Tables 6 and 7.

Most of the recommended activities are initiated in Year One. These are discussed in detail in Section II.D. The Plan will be reviewed and updated annually to develop a similarly detailed work program and general plan for succeeding years. These new programs will include work items shown on Tables 6 & 7 as well as additional recommendations which reflect new information on problems, control measures, and changed priorities. An assessment of costs and impacts will be made for new work items not covered in the Year One program.

The costs for the Five Year Program, as shown on Tables 2 & 3 were developed based on a detailed assessment of Year One costs (included in Section II.D) and an estimate of future costs. This estimate of future costs assumes that some planning activities will continue on a similar level to Year One efforts while others will fluctuate depending on problem assessment. The estimate exludes the costs of present or future public services designed to mitigate runoff pollution and includes those costs for carrying out annual planning, problem assessment and special studies.

Table 6 Schedule for Plan Implementation

INITIAL PLAN RECOMMENDATIONS	Year One Oct. 1977	June 1978	June 1979	Years Two-Five June 1980	June 1981	June 1982	June 1983

A. Accumulations of Debris and Vehicle Wastes

A.1 Establish program to determine more clearly persistent problem areas (See Item E, below).

A.2 Recommend a program to encourage improved vehicle construction and design standards.

A.3 Establish a prevention program.

a) Establish a regionwide public education program.

b) Establish a pilot education program as a test area for a regionwide or County program, focused on the lagoon areas.

c) Develop model approaches to litter and dumping controls.

d) Develop model approaches to oil recycling.

e) Develop a program to implement model approaches and public education.

f) Implement program with adjustments to reflect annual review and update.

▬▬ Period for work completion

■■■■ Interim Actions Scheduled

Table 6 cont. Schedule for Plan Implementation

INITIAL PLAN RECOMMENDATIONS	Year One Oct. 1977	June 1978	June 1979	Years Two-Five June 1980	June 1981	June 1982	June 1983
A.4 Establish an implementation program to improve the water quality benefit of existing clean-up programs for storm inlets, streams, or channels.							
a) Develop model approaches to cleaning storm inlets, catch basins, drainage pipes, channels, and streams.							
b) Develop a program to implement model approaches.							
c) Implement recommendation program with adjustments to reflect annual review and update.							
A.5 Establish a program to improve the water quality benefit of existing street sweeping programs.							
a) Develop means to help local jurisdictions maintain high levels of street sweeping especially during the rainy season.							
b) Develop model approaches to reduce on-street parking while sweeping.							
c) Develop means to help local jurisdictions increase the pick-up of fine particles when sweeping.							

Table 6 Cont. Schedule for Plan Implementation

INITIAL PLAN RECOMMENDATIONS	Year One Oct. 1977	June 1978	June 1979	Years Two-Five June 1980	June 1981	June 1982	June 1983
d) Develop a program to implement model approaches and methods.							
e) Implement recommendation program with adjustments to reflect annual review and update.							
B. Erosion and Siltation							
B.1 Determine more clearly the locations of significant erosion and siltation (see Item E, below)							
B.2 Establish a program to improve erosion and runoff controls in areas with existing or potential problems.							
a) Establish a program to improve existing erosion and runoff control practices in the unincorporated coastal area.							
o Identify and analyze existing County policies, practices and programs							
o Develop recommendations and aids for improvements							
o Implement recommendations							
o Distribute findings to other jurisdictions							

Table 6 Cont. Schedule for Plan Implementation

INITIAL PLAN RECOMMENDATIONS	Year One Oct. 1977	June 1978	June 1979	Years Two-Five June 1980	June 1981	June 1982	June 1983
b) Develop and adopt an Area Plan for the Brisbane Watershed which addresses siltation from the Brisbane Quarry							
c) Based on B.1, above, develop and implement recommendations for further work with adjustments to reflect annual review and update.							
B.3 Develop and implement flexible road standards for sensitive areas.							
a) Adopt second phase road standard revisions: Creative Road Design Guide.							
b) Based on B.1, above, develop recommendations for other areas in the County.							
C. Sewer Line Infiltration and Sewer Failure							
C.1 Recommend continued federal and State aid for infiltration/inflow analysis, and sewer line repair or replacement.							
C.2 Establish a program to determine more clearly the cause and locations of problem areas (See Item E, below).							
D. Special Water Quality Problem Areas							
D.1 Establish a program to determine more clearly the sources of suspected problems (See also Item E, below).							

Table 6 Cont. Schedule for Plan Implementation

INITIAL PLAN RECOMMENDATIONS	Year One Oct. 1977	June 1978	June 1979	Years Two-Five June 1980	June 1981	June 1982	June 1983
a) Establish improved bacteriological ranges for County shellfish monitoring program.							
b) Conduct monitoring above and below suspected problem source on Frenchman's Creek.							
c) Develop coordinated field survey or monitoring in San Pedro Creek Watershed (See Item E).							
D.2 Establish a program to solve documented problems.							
a) See Items A.3(b) and B.2(b), above for lagoon areas.							
b) Continue implementation of Foster City Lagoon Management Plan.							
c) Develop and implement other specific programs based on D.1, above, and Item E, below.							

Table 6 Cont. Schedule for Plan Implementation

INITIAL PLAN RECOMMENDATIONS	Year One Oct. 1977	June 1978	June 1979	Years Two-Five June 1980	June 1981	June 1982	June 1983
General Planning Activities.							
E. Problem Identification and Control Measure Assessment.							
E.1 Establish an interagency system to identify problems and related control measure recommendations.							
a) Establish a 208 Steering Committee Technical Subcommittee to guide development of system.							
b) Establish a specific annual work program and general 5 year work program for interagency cooperation. (See proposed actions for work program, page)							
c) Implement work program with adjustments to reflect annual review and update.							
F. Continuing Planning Process							
F.1 Establish and Implement procedures for annual review and update of Plan.							
F.2 Establish a Lead Agency.							
a) Establish a process and schedule for determining a lead agency.							

Table 6 Cont. Schedule for Plan Implementation

INITIAL PLAN RECOMMENDATIONS	Year One Oct. 1977	 June 1978	 June 1979	Years Two-Five June 1980	 June 1981	 June 1982	 June 1983
b) Determine lead agency.	—						
F.3 Establish financing mechanisms.							
a) Establish local cost-sharing mechanisms for annual update	—						
b) Determine specific cost and financing mechanisms for each annual work program.			—	—	—	—	—
G. Documenting Existing Practices							
G.1 Establish a program to document local surface runoff related practices and evaluate effectiveness of measures.							
a) Develop an annual Action Plan worksheet to direct local documentation efforts.	—	—	—	—	—	—	—
b) Implement documentation program.	—	—	—	—	—	—	—

Table 7. San Mateo County Surface Runoff Management Plan

Potential Problem	Recommendation	General Description	Implementing Agency(s)	Schedule	Enforcement Regulation	Legal Authority	Financial Mechanism	Other Incentives
A. Accumulations of debris & vehicle wastes	A.1 Establish program to determine more clearly persistent problem areas (See Item E, below)	An interagency program to coordinate field survey findings in target areas. Special surveys will be initiated in Year One.	208 Steering Committee, Technical Subcommittee	Nov., 1977 to June, 1983	An area wide permit for stormwater discharge, probably administered by the Regional Water Quality Control Board	Existing agencies: Local	Agency Resources	Possibly less duplicaton of existing field survey efforts.
	A.2 Recommend a program to encourage improved vehicle construction and design standards	A program to reduce oil leakage, toxic exhaust emissions, other vehicle byproducts.	Federal or State governments, industry	June, 1978				Multiple: water and air quality
	A.3 Establish a prevention program							
	a) Establish a regionwide public education program.	A program to encourage proper use & disposal of oil, litter, garden waste, pesticides & fertilizers.	Counties, ABAG	Sept., 1977 to June, 1983	See Above	Existing agencies		Multiple: aesthetic, water quality, drainage mosquito & rat control, energy conservation, reduced clean-up budgets.
	b) Establish a pilot education program as a test area for a regionwide or County program focused on the lagoon areas.	A test of educational techniques to benefit specific water quality problem areas.	Lead Agency, ABAG, Pilot Area Cities: Brisbane, Foster City, Redwood City San Mateo	Sept., 1977 to June, 1979		Existing agencies	Local agencies, ABAG possible demonstration grant.	
	c) Develop model approaches to litter and dumping controls.	A program to examine education, urban services, regulations or enforcement	Lead Agency, 208 Steering Committee	Oct., 1977 to June, 1979		Existing agencies	Local agencies, Remaining 208 Planning Funds	Multiple: reduced clean-up budgets.
	d) Develop model approaches to oil recycling.	A program to examine suitable locations, methods & public education.	Lead Agency, 208 Steering Committee	Oct., 1977 to June, 1979		Existing agencies	Local agencies, Remaining 208 Planing funds	
	e) Develop a program to implement model approaches and public education.	Specific implementation steps will be outlined, based on fundings of A.1, & A.3 a,b,c,d,& Gl.a, b.	Counties, ABAG, 208 Steering Committee, Lead Agency	Interim: June, 1978 Other: June, 1979			Local Agencies	Same as A.3 a) b), c), d).

Table 7 Cont. San Mateo County Surface Runoff Management Plan

Potential Problem	Recommendation	General Description	Implementing Agency(s)	Schedule	Enforcement Regulation	Legal Authority	Financial Mechanism	Other Incentives
	f) Implement program with adjustments to reflect annual review and update.	Designated agencies initiate implementation steps outlined in A.3 e)	To be determined: ABAG, Cities, County, Special dist., Flood Control Mosquito Abatement	June, 1979 to June 1983	See Above	Existing Agencies	Local	Same as A.3 a), b), c), d).
	A.4 Establish an implementation program to improve the water quality benefit of existing clean-up programs for storm inlets, streams, or channels.				See Above			
	a) Develop model approaches to cleaning storm inlets, catch basins, drainage pipes, channels, and streams.	A program to examine co-operative services, volunteer services, equipment & facilities.	Lead Agency, 208 Steering Committee	June, 1979 to June, 1980		Existing Agencies	Local	Possible multiple benefits: increased efficiency, reduced costs.
	b) Develop a program to implement model approaches.	Specific implementation steps will be outlined based on findings of A.4 a), & G.1 a) & b).	Lead Agency 280 Steering Committee	June, 1980		Existing Agencies	Local	
	c) Implement recommendation program with adjustments to reflect annual review and update.	Designated agencies initiate implementation steps.	To be determined	June, 1980 to June, 1983				
	A.5 Establish a program to improve the water quality benefit of existing street sweeping programs.				See Above			
	a) Develop means to help local jurisdictions maintain high levels of street sweeping especially during the rainy season.	A program to examine cooperative services, scheduling, financial arrangements	Lead Agency, 208 Steering Committee	Oct., 1977 to June, 1979		Existing Agencies	Local, Remaining 208 funds	Multiple: drainage, local budgets.
	b) Develop model approaches to reduce on-street parking while sweeping.	A program to examine optimum scheduling and/or parking regulations	Lead Agency, 208 Steering Committee	Oct., 1977 to June, 1979		Existing Agencies	Local Agencies, Remaining 208 funds	Multiple: more efficient litter pick-up.

Table 7 Cont. San Mateo County Surface Runoff Management Plan

Potential Problem	Recommendation	General Description	Implementing Agency(s)	Schedule	Enforcement Regulation	Legal Authority	Financial Mechanism	Other Incentives
	c) Develop means to help local jurisdictions increase the pick-up of fine particles when sweeping.	A program to examine means to finance improved equipment, operator training, optimum use of existing equipment/personnel.	Lead Agency, 208 Steering Committee	Oct., 1977 to June, 1979		Existing Agencies	Local Agencies, Remaining 208 funds	Possible increased efficiency.
	d) Develop a program to implement model approaches and methods.	Specific implementation steps will be outlined based on findings of A.5 a),b), & c); & G.1a) &b).	Lead Agency 208 Stering Committee	Interim: June, 1978 Other: June, 1979		Existing Agencies	Local Remaining 208 funds	
	e) Implement recommendation program with adjustments to reflect annual review and update.	Designated agencies initiate implementation steps outlined in A.5 d).	Cities & County	Interim: Aug., 1978 Other: Aug., 1979	See Above	Existing Agencies	Local Agencies	Same as A.5 a), b), c).
B. Erosion & Siltation								
	B.1 Determine more clearly the locations of significant erosion and siltation (see Item E, below)	An interagency program to coordinate field survey findings in target areas.	208 Steering Committee, Technical Subcommittee	Nov., 1977 to June, 1983.		Existing Agencies	Agency Resources	Site specific problem solving
	B.2 Establish a program to improve erosion and runoff controls in areas with existing or potential problems.							
	a) Establish a program to improve existing erosion and runoff control practices in the unincorporated coastal area.	A program coordinated with local Coastal planning efforts to implement best management practices on the Coast	County 208 Steering Committee	Oct., 1977 to Dec., 1978	Subdivision, grading, zoning, EIR & other Co. policies, ordinances, plans & guidelines	Existing Agencies	Local Coastal Program grant, Remaining 208 funds	Coordination with other Coastal planning efforts.

Table 7 Cont. San Mateo County Surface Runoff Management Plan

Potential Problem	Recommendation	General Description	Implementing Agency(s)	Schedule	Enforcement Regulation	Legal Authority	Financial Mechanism	Other Incentives
	o Identify and analyze existing County policies, practices and programs	Erosion & runoff controls are embodied in numerous programs.	County	Oct., 1977 to June, 1978				
	o Develop recommendations and aids for improvements.	Special research will be conducted & recommendations made for improvements or additions to existing programs.	County, 208 Steering Committee	Oct., 1977 to Dec., 1978				
	o Implement recommendations	According to recommended timetable	County	Dec., 1978 to June, 1980	See Above	Existing Agencies	Local	Model approach for other agencies
	o Distribute findings to other jurisdictions	County policies could serve as models for others.	County	Dec., 1978 to June, 1979				
	b) Develop and adopt an Area Plan for the Brisbane Watershed which addresses siltation from the	The Guadalupe Valley Area Plan will be developed to implement this recommendation	County	Sept., 1977 to Sept., 1978	General Plans	Existing Agencies	County Service Area funds, Co.	Coordination with pilot education program
	c) Based on B.1, above, develop and implement recommendations for further work with adjustments to reflect annual review and update.	Other specific erosion or siltation areas will be identified & site-specific recommendations developed as in B.2 a) & b).	County 208 Steering Committee	June, 1979 to June, 1983	Areawide permit for storm water discharge.			
	B.3 Develop and implement flexible road standards for sensitive areas.							Multiple: conserving natural environment, resources, neighborhood quality
	a) Adopt second phase road standard revisions: Creative Road Design Guide.	A model manual for implementing flexible road standards which can reduce runoff.	County	Dec., 1978	County Ordinance	Existing Agencies	County Funds	

Table 7 Cont. San Mateo County Surface Runoff Management Plan

Potential Problem	Recommendation	General Description	Implementing Agency(s)	Schedule	Enforcement Regulation	Legal Authority	Financial Mechanism	Other Incentives
	b) Based on B.1, above, develop recommendations for other areas in the County.	Other jurisdictions may have sensitve areas where flexible standards should apply	Lead Agency, 208 Steering Committee	June, 1978 to June, 1980	Areawide permit for stormwater discharge	Existing Agencies	Local Funds	
C. Sewer Line Infiltration & Failure	C.1 Recommend continued federal and State aid for infiltration/inflow analysis, and sewer line repair or replacement.	Several areas still need help to study sewer lines & to develop a repair program to prevent sewage spills into drainageways	State, Federal government, local agencies	June, 1978				
	C.2 Establish a program to determine more clearly the cause and locations of problem areas (See Item E, below).	A cooperative program to isolate sewage leaks, particularly near special problem areas.	Local cities, Co. districts.	Nov., 1977 to June, 1983	See above	Existing Agencies	See Item E, below	Public Health
D. Special Problem Areas	D.1 Establish a program to determine more clearly the sources of suspected problems (See also Item E, below).	An ongoing program to isolate specific problem sources (see below)						
	a) Establish improved bacteriological ranges for County shellfish monitoring program.	Narrower ranges for bacterial testing will better reflect shellfish conditions	County Environmental Health Office	Oct., 1977 to June, 1983	Existing Authorities	Existing Agencies	County	Multiple benefits. Public Health, Possible Commercial shellfishing.
	b) Conduct monitoring above and below suspected problem source on French Creek	A program to isolate a possible problem source	County Environmental Health Officer	Oct., 1977 to June, 1979	Existing Authorities	Existing Agencies	County	Multiple benefits; Public Health, Fish Resources
	c) Develop coordinated field survey or monitoring in San Pedro Creek Watershed (See Item E).	An interagency program to isolate possible sewer leaks, illegal discharges, debris, or other problem sources	208 Steering Committee Technical Subcommittee	Nov. 1977 to June, 1979	Existing Authorities	Existing Agencies	Agency Budgets	Multiple benefits rat control, public health, fish resources
	D.2 Establish a program to solve documented problems.							

Table 7 Cont. San Mateo County Surface Runoff Management Plan

Potential Problem	Recommendation	General Description	Implementing Agency(s)	Schedule	Enforcement Regulation	Legal Authority	Financial Mechanism	Other Incentives
	a) See Items A.3(b) and B.2(b), above for lagoon areas.							
	b) Continue implementation of Foster City Lagoon Management Plan.	The management Plan is being revised & will be implemented.	Foster City	Continuing	NPDES permit	Existing Agencies		Multiple benefits: fish resources, recreation, aesthetics.
	c) Develop and implement other specific programs based on D.1, above, and Item E, below.		Lead Agency, 208 Steering Committee	Nov., 1977 to June, 1983			Local	
	General Planning Activities.							
E. Problem Identification & Control Measure Assessment	E.1 Establish an interagency system to identify problems and related control measure recommendations.	A program to coordinate existing State, Federal, regional & local agencies to solve special environmental problems.	Lead Agency, 208 Steering Committee	Nov., 1977 to June, 1983	Areawide permit for stormwater discharge	Existing Agencies	Existing Agencies, Remaining 208 funds.	Multipel benefits less duplication, better use of available agency budgets, more problem solving
	a) Establish a 208 Steering Committee Technical Subcommittee to guide development of system.	Affected agencies should develop priorities & procedures for working together.	Lead Agency, 208 Steering Committee, 32 agencies (see Table 10).	Nov., 1977	See above	Existing agencies	See above	
	b) Establish a specific annual work program and general 5 year work program for interagency cooperation. (See proposed actions for work program, page 70)	Affected agencies will determine their priorities for cooperative work. A program focused on special runoff-related problems is proposed.	See above	Nov., 1977 to June, 1978	See above	Existing agencies	See above	
	c) Implement work program with adjustments to reflect annual review and update.	Priorites may change annually & a new work program needed.	See above	Interim: Jan., 1977 June, 1978 Other: June 1979 to June 1983	See above	Existing agencies	See above	

Table 7 Cont. San Mateo County Surface Runoff Management Plan

Potential Problem	Recommendation	General Description	Implementing Agency(s)	Schedule	Enforcement Regulation	Legal Authority	Financial Mechanism	Other Incentives
F. Continuing Planning	F.1 Establish and Implement procedures for annual review and update of Plan.	Annual adjustments may be necessary to reflect changed priorities or funding.	Lead Agency, 208 Steering Committee	March to June each Year.	See above	Existing Agencies	See above	Bay Area 208 Plan must be updated. This will assure County input
	F.2 Establish a Lead Agency.	A combination of two options is suggested for local review & decision: a 208 Steering Committee & one lead agency. The Co. Planning Div. is recommended for this role	County, cities, Other: Mosquito Abatement, Resource Conservation District	By June 1978	See Above	A joint powers agreement may be necessary	See F.3	Help assure conformance with 208 requirements; assure local policy direction.
	a) Establish a process and schedule for determining a lead agency.							
	b) Determine lead agency.			March 1978				
	F.3 Establish financing mechanisms.							
	a) Establish local cost-sharing mechanisms for annual update	A program to share costs to diminish lead agency burden for areawide program	See above	March, 1978	See above	See above	Local	Assure conformance with 208 requirement.
	b) Determine specific cost and financing mechanisms for each annual work program.	Each annual work program should identify local, regional, State or Federal funds to implement program	Lead Agency, 208 Steering Committee	March to June each year			Part of annual update costs.	
G. Documenting Local Practices	G.1 Establish a program to document local surface runoff related practices and evaluate effectiveness of measures.	Existing experience & programs should serve as the basis for recommendations.	Lead Agency, 208 Steering Committee	March to June each year	See above	Existing Agencies	Local	Development of model approaches to common local problems
	a) Develop an annual Action Plan worksheet to direct local documentation efforts.	Those programs being addressed for the year would be examined in detail.		March to June each year			Local	
	b) Implement documentation program.	Each agency will complete the annual worksheet.	County, cities, districts	Sept. 1977 to June 1983	See above	Existing Agencies	Local	See above

D. YEAR ONE WORK PROGRAM

This section describes in detail those activities which can be initiated in the Year One period to help lay a sound foundation for more clearly identifying problems, establishing a continuing planning process, and improving or supplementing existing management practices. Table 6 indicates those activities which should begin in this period.

The recommended program of activities includes both specific control measure activities for priority problems, as well as more general activities for further problem identification and continued planning.

The Year One program is the first phase of a long-range process. Each activity described here will be evaluated for its effectiveness both <u>during</u> the Year One time period and at its conclusion. Evaluations will include specific recommendations for further work programs.

Each control measure activity for Year One except for recommendations for federal, State or regional efforts is discussed according to the following categories:

- <u>Objective(s)</u> - A statement of what the measure will attempt to achieve.
- <u>General Description</u> - A discussion of one or more specific activities which will help implement the control measure objectives.
- <u>Schedule</u> - A detailed work program outline for the various activities.
- <u>Assessment</u> - A discussion of the environmental, economic, social, and institutional/financial impacts of the activities. This portion includes a discussion of <u>who</u> would implement the activities, and estimated costs for these activities.

The assessment for each control measure was developed using several guidelines:

- The Environmental Management Task Force developed an assessment checklist which includes sixteen categories of potential control measure impacts. An assessment procedures manual provided by ABAG details specific issues for each of these checklist categories. These tools formed a basis for the assessments in this report.
- Cost estimates for control measures were developed using the assumptions indicated on Table 8.

TABLE 8

COST ASSUMPTIONS FOR YEAR ONE PROGRAM

1. Personnel Costs.

Personnel costs were developed assuming a basic salary and 40 percent overhead. The salary figures are derived from County salary tables, and an assumption that City or County representatives are generally upper level management earning approximately $36,000 per year. The costs are provided in terms of cost per hour.

PERSONNEL	BASIC SALARY	OVERHEAD	TOTAL
City or County Agency Representatives	$17.36	40%	$24.30/hr.
208 Coordinator	$13.37	40%	$18.72/hr.
Research Assistant	$ 7.48	40%	$10.47/hr.
Coastal Program Coordinator	$ 9.60	40%	$13.44/hr.
Communications Specialist	$ 7.32	40%	$10.25/hr.
D.A. Legal Assistance	(Includes overhead)		$35.00/hr.
Technical or Educational Consultants	A total estimated dollar figure will be used.		
Secretarial	$ 5.09	40%	$ 7.13/hr.
Field Assistants (CETA or Other)	$ 5.00	40%	$ 7.00/hr.

The total cost for agency participation assumes participation by 19 cities and four County departments (Environmental Health, Public Works, Environmental Management, County Manager), and participation by two other local agencies, (the Resources Conservation District and Mosquito Abatement District). The total local participation for many actions (meetings, action plan documentation) can be as much as 25 agencies.

Participation by State or Regional agencies is assumed to be voluntary, and costs are not calculated for such participation, except in the case of Recommendation E.1 where they may be asked to contributed to costs.

2. Materials Costs.

Materials costs generally would be those for printing and distributing summary reports. These costs are assumed as part of the overhead.

Where special printing requirements exist (i.e. educational brochures or materials), these are estimated as a total dollar figure.

1. SPECIFIC CONTROL MEASURE ACTIVITIES

ACCUMULATIONS OF DEBRIS AND VEHICLES WASTES

Problem A: Accumulations of
Debris and Vehicle Wastes

Measure: A.3. Establish a coordinated prevention program.

Objectives: The objective of each of the activities identified for this control measure is to decrease the accumulation of potential pollutants on streets, lots, storm inlets and drains, and eventually receiving waters.

Description: A prevention program could consist of many actions to reduce dumping and littering and improve use and disposal of chemicals or oil. Increased public awareness and adequate waste disposal alternatives could be provided. For purposes of the Year One program, the following actions are recommended. It is recommended that these be initiated in Year One of the Plan:

a) Establish a regionwide public education program. A regionwide approach would be beneficial, as it could provide a common logo, materials for distribution, and direction regarding the most effective approach for different audiences. A regionwide approach could also effectively utilize the mass media. It should be noted that a regionwide approach would not preclude local efforts, but could provide support and direction for more intensive local work.

b) Establish a pilot education program as a test area for a regionwide or County program, focused on the lagoon areas. A grant proposal is being prepared which outlines a possible regional pilot study to be conducted in the portions of Brisbane, Redwood City, San Mateo, and Foster City which drain directly into lagoons. An educational program is of interest to these cities as either a pilot for the region or a more local effort. If it is pursued as a local effort (due to grant funding or timing constraints) only one area can be selected for focus through June, 1978. The recommended area would be Brisbane, due to high interest.

c) Develop model approaches to litter and dumping controls. Numerous existing programs in San Mateo County and elsewhere either discourage littering/dumping through education, ordinances, and inspection or provide ready alternatives such as dumps, garden waste pickup, recycling centers, public trash cans, and neighborhood composting centers. The most or least effective practices used by a jurisdiction should be identified for the benefit of others.

Model approaches would be developed under the direction of the 208 Steering Committee and all affected agencies.

d) Develop model approaches to oil recycling. Some work has already been done by the American Association of University Women's (AAUW) ROAR (return oil and re-refine) program and by the State legislature. This measure would involve work with the 208 Steering Committee, AAUW, Bayside Oil, recycling centers, service stations, and cities.

e) Develop a program to implement model approaches and public education. The Lead Agency and 208 Steering Committee would work with local jurisdictions to develop an implementation program for the model preventative approaches and public education ideas developed. This implementation program would be flexible and would reflect the differing needs and capabilities of local jurisdictions. It could be modified during each Plan review and update.

Interim recommendations may be made during the Year One interim update, June, 1978.

Schedule:

By September, 1977

- County, selected cities, and ABAG develop pilot project grant proposal.

By October 12, 1977

- County Runoff Plan request inclusion of activity (a) above in Bay Area Environmental Management Plan.
- Local Action Plan worksheet identify effective litter and dumping controls.
- Local Action Plans and groups indicate level of interest and ideas for model oil recycling program.

By December, 1977

- County, selected cities, and ABAG develop specific work program for educational pilot project.
- County initiate cooperative efforts with 208 Steering Committee and local groups to develop work program on model approaches to oil recycling.

By January, 1978

- County, ABAG, and city(s) initiate educational program in one or more of the selected cities.

By June, 1978

- o Lead Agency and 208 Steering Committee summarize and distribute interim findings on model approaches to littering, dumping, and oil recycling and determine any interim recommendations for implementation.

- o County, ABAG, and cities develop an Interim Report on the educational program, for distribution to other jurisdictions.

By August, 1978

- o Local jurisdictions initiate implementation of interim recommendations.

By June, 1979

- o Lead Agency, 208 Steering Committee distribute report on model approaches.

- o County, ABAG, and cities complete pilot education study and distribute findings to other jurisdictions.

- o Lead Agency, 208 Steering Committee develop recommendations for implementing model approaches and public education.

Assessment:

a) Environmental: The precise environmental impact of a program designed to prevent littering and dumping cannot easily be predicted. Many people are simply not aware that actions in their neighborhood may be affecting important water bodies. Increased education on the possible harm, and on alternative disposal methods could decrease the amounts of garden waste, oil, and debris deposited in inappropriate areas (storm inlets, channels, etc.). The pilot study is proposed to help quantify the results of such preventative efforts before expanding to a County or region wide program. It may be found that other controls identified in activities (c) and (d), above, would be needed to supplement education. The pilot study would have the additional benefit of directly aiding identified water quality problem areas.

If an EPA grant is received, it would probably fund only 75% of a pilot the project through June, 1979. If local in-kind services are required, the cities involved may not wish to participate in a regional pilot effort. A smaller-scale local effort could be funded through some local and remaining County 208 funds.

b) Economic: The only impacts which might be expected would be from the oil recycling program. It could increase the markets for special automotive goods and services, affect the income and investments of oil refiners and retailers, and alter consumer expenditure patterns.

c) Social: A prevention program could improve the health and safety of local communities and possibly heighten the public's civic pride and sense of community.

d) Institutional/Financial: The institutional and financial impact on local governments of this control measure should be minimal. The following indicates the estimated activities, costs and sources of funds for local San Mateo County efforts. Assumptions used on salaries are indicated on Table 8. Many expenditures would depend on remaining 208 planning funds or outside resources. Local funds would be needed primarily to complete the local Action Plan, attend meetings, and develop model approaches.

Notable exceptions are the local pilot programs on education. The regional program would be funded by an EPA matching grant, where 25% of the funding would have to be local. The source of such funds could be ABAG, with in-kind services requested of local cities. The local program would require some services of the City of Brisbane which has expressed willingness to assist through present management, secretarial, and possibly CETA personnel.

Activities	Costs		Sources
Recommendation: A.3(b) - Local Pilot Education			
o Develop work program:			
- 208 Coordinator	40 hrs. x $19	= $ 760	208
- Educational Consultant		= $2,000	208
- Communication Specialist	80 hrs. x $10	= $ 800	208
- Brisbane Management	40 hrs. x $24	= $ 960	Local
- Secretarial	40 hrs. x $7	= $ 280	Local
- ABAG*	20 hrs. x $19	= $ 380	ABAG 208
- Local Agencies**	8 hrs. x $24 x 6	= $1,152	Local
o Implement Program			
- 208 Coordinator	40 nrs. x $19	= $ 760	208
- Educational Consultant		= $1,000	208
- Communications Specialist	40 hrs. x $10	= $ 400	208
- Brisbane Management	80 hrs. x $24	= $1,920	Local
- Secretarial	40 hrs. x $7	= $ 280	Local
- Field Assistant	3 months x $800	= $2,400	CETA or Local
- Local Agencies**	8 hrs. x $24 x 6	= $1,152	Local
o Total		$14,244	

*ABAG salary assumed to be the same as County 208 Coordinator.

**Includes: <u>County Offices</u> - Public Works, Environmental Health
<u>Cities</u> - San Mateo, Foster City, Redwood City
<u>Districts</u> - Mosquito Abatement

Activities	Costs		Sources
Recommendation: A.3(b) - Regional Pilot Education			
o Develop a pilot project proposal			
- 208 Coordinator	20 hrs. x $79 =	$380	208
- Local Agencies **	2 hrs. x $24 x 4 =	$192	Local
- ABAG	10 hrs. x $19 =	$190	ABAG 208
o Subtotal		$762	
o Develop and implement work program*			
- Local ***	0 - $14,143	25% of Total	
- County (208)	or		
- ABAG	$190 - $14,333		
- EPA	$42,433 -	75% of Total	
o Total	$37,338		

*This work is optional based on availability of EPA grant and local or regional matching funds.

** Includes: Cities - San Mateo, Foster City, Redwood City, Brisbane.

*** San Mateo, Foster City, Redwood City

Activities	Costs	Sources
Recommendation: A.3(c) - Model Litter/Dumping Controls		
o Local Action Plan *	4 hrs. x $24 x 25 = $2,400	Local
o Develop and distribute materials on model approaches in County & elsewhere		
- 208 Coordinator	20 hrs. x $19 = $ 380	208
- Research Assistant	80 hrs. x $10 = $ 800	208
- Secretarial	8 hrs. x $7 = $ 56	208
- 208 Steering Committee	4 hrs. x $24 x 10 = $ 960	Local
- City/Agency Review & Comment	4 hrs. x $24 x 25 = $2,400	Local
o Total	$6,988	
* Includes: <u>County Offices</u> - Public Works, Environmental Health, Environmental Management (Planning Division), and County Manager. <u>Cities</u> - 19 <u>Other</u> - Resource Conservation District, Mosquito Abatement District.		

Activities	Costs	Sources
Recommendation: A.3(d)- Oil Recycling		
o Local Action Plan	2 hrs. x $24 x 25 = $1,200	Local
o Contact groups*		
- 208 Coordinator	20 hrs. x $19 = $ 380	208
o Develop work program		
- 208 Coordinator	20 hrs. x $19 = $ 380	208
- Research Assistant	80 hrs. x $10 = $ 800	208
- Groups	Unknown	
o Develop and distribute material recommendations		
- 208 Coordinator	20 hrs. x $19 = $ 380	208
- Research Assistant	80 hrs. x $10 = $ 800	208
- Groups	Unknown	
- Secretarial	10 hrs. x $7 = $ 70	208
- Special Materials	= $2,000	208
- Local Agencies	2 hrs. x $24 x 25 = $1,200	Local
o Total	= $7,210	

* Includes: County Offices - Public Works, Environmental Health, Environmental Management (Planning Division), and County Manager.

Cities - 19

Other - Resource Conservation District, Mosquito Abatement District.

* To the extent that volunteer groups are able to carry out this program, staff costs could decrease substantially.

Measure: A.5 Establish a program to improve the water quality benefits of existing street sweeping programs in San Mateo County.

Objectives: The objective of this control measure would be to identify actions which can help increase the pick-up of potential pollutants prior to precipitation.

Description: A program to improve street sweeping benefits could consist of many actions which increase the area swept, concentrate sweeping in problem areas, increase the pick-up of fine particles (the carriers of toxic vehicle wastes), or maintain or develop satisfactory levels of sweeping prior to rains.

For purposes of the Year One Program, the following actions are recommended:

a) Develop means to help local jurisdictions maintain high levels of street sweeping, especially during the rainy season. Most jurisdictions in the County have high levels of service year-around and some increases in the autumn during leaf-fall. Means of maintaining service levels in the face of increasing local government budget problems should be explored.

Options which could help local jurisdictions include:

- Cooperative service provision. Street sweeping districts or joint powers agreements might be useful in helping neighboring jurisdictions maintain or increase their sweeping services at minimal cost. Purchase of costly but potentially very effective vacuum sweepers could be aided by such arrangements.

- Rescheduling of services. If budget or service cuts are anticipated, water quality benefit could probably still be achieved if the highest levels of service are maintained during the rainy season in areas of high pollution, with lower levels allowed at other times and places.

This measure would involve identifying agencies interested in cooperative services, assisting in the legal, financial, and institutional arrangements necessary for such agreements, and identifying feasible means for implementing seasonal variations in service levels.

b) Develop model approaches to reduce on-street parking while sweeping.

Most potential surface runoff pollutants accumulate near the curbs. Programs to reduce on-street parking could markedly increase the pick-up of such materials. Several options should be investigated in developing a model approach:

- o Improved scheduling and public information could encourage voluntary off-street parking in residential areas. Redwood City has found good cooperation when people know when to expect the sweeper.

- o Improved scheduling in commercial areas could be tied to hours when few on-street cars would be in the area (early morning or other low traffic). This is also practiced in many areas.

- o Parking restrictions would be effective in areas where voluntary action or ideal scheduling cannot be accomplished. There are many options available for such restrictions, including: no on-street parking allowed (continually, or on certain days or hours), or parking limited to one side of the street on certain days.

c) Develop means to help local jurisdictions increase the pick-up of fine particles when sweeping. Most heavy metals such as lead exist on the streets as fine, dust-like particles. Conventional street sweeping operations generally do not focus on such particles.

Options to increase their pick-up could include:

- o vacuum sweepers.

- o operator training.

- o adjusting equipment.

- o concentrating efforts where and when most particles accumulate.

This measure would involve identifying more clearly the cost and effectiveness of the options indicated above, and feasible means to encourage their implementation.

d) Develop program to implement model approaches and methods. The Lead Agency and 208 Steering Committee would work with local jurisdictions to develop an implementation program for model approaches and methods. Interim recommendations may be made during the Year one Interim update, June, 1978.

Schedule for Year One

By October 12, 1977

County and Cities identify in local Action Plans the following:

a) o Existing cooperative service agreements for sweeping.

- o Level of interest in cooperative service provision.

- o Level of interest in pursuing seasonal variations in service levels.

b) o Elements of effective parking or scheduling programs designed to increase sweeping efficiency.

- o Level of interest in pursuing pilot or larger scale parking or scheduling options.

c) o Local experience and interest in vacuum sweepers.

- o Level of interest in operator training.

By January, 1978

- o Summarize findings of local Action Plans and distribute.
- o Schedule a meeting of jurisdictions to develop and implement a specific work program to meet their needs.

By March, 1978

- o Summarize and distribute any research findings on the control measures.

By June, 1978

- o Lead Agency and 208 Steering Committee develop an interim report and recommendation on findings.

By August, 1978

- o Local jurisdictions initiate implementation of interim recommendations.

By June, 1979

- o Report findings on model approaches and means to improve existing street sweeping.
- o Lead Agency and 208 Steering Committee recommend program to implement model approaches and methods.

Assessment:

a) Environmental: Improved street sweeping practices could help diminish the amount of vehicle wastes (exhaust emissions, oil, etc.) and street refuse or litter which can enter the drainage system. These amounts can be significant, as shown in Table 9. The precise water quality benefit of removing these materials is not completely known. The activites indicated for Year One are essentially common-sense approaches to increasing the probability that street pollutants will be picked up prior to rain.

TABLE 9
The Quantity and Quality of Street Surface Contaminants*

Measured Constituents	Weighted Means For All Samples (lb/curb mile)
Total Solids	1400
Oxygen Demand	
BOD^5	13.5
COD	95
Volatile solids	100
Algal Nutrients	
Phosphates	1.1
Nitrates	.094
Kjeldahl Nitrogen	2.2
Bacteriological	
Total Coliforms (org/curb mile)	99×10^9
Fecal Coliforms (org/curb mile)	5.6×10^9
Heavy Metals	
Zinc	.65
Copper	.20
Lead	.57
Nickel	.05
Mercury	.073
Chromium	.11
Pesticides	
p,p-DDD	67×10^{-6}
p, p-DDT	61×10^{-6}
Dieldrin	24×10^{-6}
Polychlorinated Biphenyls	1100×10^{-6}

* Taken from Water Pollution Aspects of Street Surface Contaminants, James D. Sartor and Gail B. Boyd, U.S.E.P.A., November, 1972.

National and Bay Area research may help indicate more precise information on the cause and effect relationships between street surface materials, street sweeping operations, and water quality.

b) Economic. It is possible that these control measure activities will lead to changes in public services. These changes could increase the demand for special equipment (i.e. vacuum units, new brooms, parking signs), and could effect employment opportunities. Cooperative services might either increase or decrease personnel needs.

Rescheduling services can adversely affect personnel on a seasonal basis if jobs are cut in the summer in order to increase rainy season services.

Activities	Costs	Sources
Recommendation: A.5 - Street Sweeping		
Phase I: Develop Information		
o Local Action Plan*	4 hrs. x $24 x 20 = $1,920	Local
o Research on Methods Used Elsewhere	160 hrs. x $10 = $1,600	208
o Summary of Information in Action Plans		
- Research Assistant	20 hrs. x $10 = $ 200	208
- 208 Coordinator	16 hrs. x $19 = $ 304	208
o Total	$4,024	
Phase 2: Develop Improvements		
o Developing Possible Improvement Actions; Interim Report Recommendations		
- Local Jurisdictions (per meeting)	2 hrs. x $24 x 20 = $ 960	Local
- 208 Coordinator	16 hrs. x $19 = $ 304	208
- Research Assistant	40 hrs. x $10 = $ 400	208
- Secretarial	16 hrs. x $ 7 = $ 112	208
- Special Consultant Assistance (technical experts, lawyers)	$2,000	208
o Total	$3,776	
o Grand Total	$7,800	
* Includes: County Offices - Public Works Cities - As many as 19.		

EROSION AND SILTATION

Problem B: Erosion and Siltation

Measure B.2: Establish a program to improve erosion and runoff controls in areas with existing or potential problems.

Objectives: To decrease erosion and siltation resulting from land management practices (tillage, construction, grazing) and from increases in runoff volume or velocity associated with new urban development.

Description: This measure would consist of special studies focused primarily in special problem areas, but with possible benefits for other locations covered by similar erosion or runoff control policies. The Plan identifies two special area studies to be initiated in Year One. Other special studies would be developed based on identification of other problem areas. These two special area studies are described below.

a) Establish a program to improve existing erosion and runoff control practices in the unincorporated Coastal area.

This measure would consist of a short-term study to be undertaken as a supplement to San Mateo County coastal planning efforts. This coastal planning program will be evaluating all ordinances and General Plan elements for consistency with the California Coastal Act (1976). The effort is scheduled for October, 1977 to December 1978. A supplementary study of erosion and runoff control practices will be both timely and less costly if undertaken at the same time.

A specific work program for this effort will be developed in conjunction with all affected agencies. The study will consist of the following:

- Identify and analyze existing County policies, practices, and programs. This analysis would be for the purpose of identifying inconsistencies, gaps, and management problems. Existing practices are found in many different regulations or guidelines administered by several County departments and other agencies such as cities, Resource Conservation District, Coastal Commission, Farm Advisor etc. This diffusion in responsibility and controls may have created problems of its own.

- Develop recommendations and aids for improvements. These would be developed, along with a program for such improvements. Such recommendations would be developed using local staff experts and research. The feasibility of a stream corridor protection ordinance may be examined. Special EIR guidelines and grazing controls could be developed.

b) Develop an Area Plan for the Brisbane Lagoon watershed which addresses siltation from the Brisbane quarry.

A Guadalupe Valley Area Plan study has been required by the San Mateo County Board of Supervisors. This study will be focused on problems in the Brisbane Lagoon watershed related to the Brisbane quarry. A precise plan for the Valley will be developed which addresses land use policies in the Brisbane, County, and San Bruno Mountain General Plans. New policies for circulation and environmental management will be developed which include policies on erosion, and runoff. Work on this study will be coordinated with the proposed pilot education study for the Brisbane area.

c) Based on B.1, above, develop recommendations for further work.

Schedule for Year One

- By September, 1977, initiate Guadalupe Valley Area Plan work program.

By November, 1977

- County and interested agencies develop work program for Coast.

By January, 1978

- County and agencies initiate coastal work program.

By June, 1978

- County and agencies develop report with recommendations.

By September, 1978

- Complete and adopt Guadalupe Valley Area Plan.

By December, 1978

- Initiate implementation of recommendations.

By March, 1979

- Distribute findings on erosion and runoff control policies to other agencies in County and region.

By June, 1979

- Develop recommendations for further work.

Assessment:*

a) Environmental. Improvements in erosion and runoff control practices are expected to diminish the potential loss of topsoil and natural stream areas, as well as decrease the potential for excessive siltation. Crops, grazing land, and riparian habitat could be protected. The specific changes which might occur cannot be predicted, as there is little historic monitoring data. It should be noted, however, that management of existing controls may be changed, rather than changing controls.

b) Economic. Indirect economic impacts could develop as a result of this study, if recommendations are made to significantly alter agricultural and land use practices. On the Coast, some of these indirect impacts could be beneficial in the long-term by protecting soil resources and decreasing flooding and resulting loss of natural amenities. However, any significant alteration in practices could create short-term economic hardships for agriculture, the construction industry, and associated businesses.

c) Social. It is possible that an indirect result of this study would be an increase in the cost of housing and agriculture, affecting the overall land use pattern and housing supply. Such changes could have a disproportionate impact on lower income groups.

Efforts to decrease runoff volume and velocity could help protect public health and safety by decreasing downstream flooding.

d) Institutional/Financial. This measure would be carried out under the lead of the County Planning Division in conjunction with its Coastal Planning efforts. Several other agencies and departments would be involved: County Public Works, County Building Inspection, County Environmental Health, County Agricultural Commissioner, the Resource Conservation District, Sea Grant Coordinator, Army Corps of Engineers, California Fish and Game, Water Districts, Farm Advisor, Coastal Commission, and nearby cities. It should be noted that this study may recommend changes in administrative management practices that could significantly affect these agencies.

The following chart indicates the estimated activities, costs and funding sources for these measures. Remaining 208 Planning funds are known to be available through June 1978, when an interim report is to be prepared. The possibility of extending any remaining 208 funds after that time will be explored when developing the detailed work program scope.

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* For the Guadalupe Valley Area Plan an environmental impact report will be prepared which addresses environmental, economic, social, institutional and financial impacts. However, costs for the study are indicated here.

Activities	Costs	Sources
Recommendation: B.2(a) Coastal Study		
o Develop Work Program		
- 208 Coordinator	20 hrs. x $19 = $ 380	208
- Coastal Program Coordinator	40 hrs. x $13 = $ 520	208
- Other agencies (3 meetings)	3 hrs. x $24 x 8* = $ 576	Local
- Secretarial	8 hrs. x $7 = $ 56	208
- Research Assistant	20 hrs. x $10 = $ 200	208
o Implement Work Program		
- 208 Coordinator	60 hrs. x $19 = $1,140	208
- Coastal Program Coordinator	80 hrs. x $13 = $1,040	208
- Research Assistant	4 months = $6,400	208
- Consultant	= $2,000	208
- Local agencies (3 meetings)	3 hrs. x $24 x 8 = $ 576	Local
- Secretarial	40 hrs. x $7 = $ 280	208
o Implement Recommendations (i.e. develop new ordinances, guidelines)		
- Contingency	= $3,000	208
o Total	$16,168	

*Includes: Local Agencies -
County Offices - Public Works, Planning, Building, Environmental Management; Agricultural Commission

Cities - Pacific, Half Moon Bay

Districts - Resource Conservation District, Mosquito Abatement

State or Federal - involved, but not included in cost estimates: Farm Advisor, Sea Grant Coordinator, Coastal Commission, Army Corps of Engineers, California Fish and Game.

Activities	Costs *	Sources
Recommendation: B.2(b) Guadalupe Valley Area Plan		
o Implement Work Program		
- Planning Division Staff		
Planner III	14 person months = $28,500	County Service
Senior Planner	1 person month = $ 2,200	Area #9 and
Other	= $ 4,400	General Revenues
- LAFCo	1 person month = $ 3,000	
- Publication & Graphics	$ 6,000	
o Total	$35,000 - 44,200	

* Taken from Draft Guadalupe Valley Area Plan, San Mateo County Planning Division, August, 1977.

Measure B.3: Develop and implement flexible road standards for sensitive areas.

Objectives: To reduce the amount and velocity of stormwater runoff; to reduce the probability of increased streambed erosion; to reduce grading and disturbance of vegetation and natural features.

Description: This measure consists of adopting the new Creative Road Design Guide and assessing its value for other jurisdictions in the County. These new road criteria will be published and adopted by the County during Year One. A specific work program to assess their applicability elsewhere will be developed in the second year under the direction of the 208 Steering Committee.

Assessment: The new County road criteria can apply when modifications to road or right-of-way design would help protect the natural environment, conserve resources and preserve neighborhood quality. Public safety cannot be adversely affected by any modification.

Because the work on these new road criteria is essentially complete, a separate assessment of costs is not included in this report.

SEWER LINE INFILTRATION AND FAILURE

Problem C: Sewer Line Infiltration and Failure

Sewer line infiltration and failure can become a surface runoff problem when sewage is spilled into the drainage system. The State and federal governments have provided funds for many local jurisdictions to study sewer lines and determine infiltration points which could lead to sewer failures. There are some communities which will still need outside assistance to develop and implement a program for repair or replacement. Priorities for assistance should take into account proximity to identified water quality problems. For these reasons the Plan recommends the following to be initiated in Year One.

Measure C.2: Establish a program to determine more clearly the cause and locations of problem areas.

Objectives: To focus available State, federal or local agency resources in areas with sensitive water quality problems; to reduce possible sewage spills into such areas.

Description: Special priority should be given to areas in close proximity to sensitve water quality. One example of this would be San Pedro Creek in Pacifica. Higher priority could be given for the analysis and repair of the sewer line system in this watershed to help reduce possible sewage spills. In addition to Measure C.1 above, an interagency effort is suggested for this and other efforts in Item E, below.

The assessment for Measure C.2 is provided in Section E.

SPECIAL PROBLEM AREAS

Problem D: Special Water Quality Problem Areas

Many of the special water quality problem areas identified in the initial study need to be studied in more detail before appropriate control measures can be defined. Other problems may not require such study before some mitigation measures can be initiated. For these reasons the Plan recommends the following to be started in Year One:

Measure D.1: Establish a program to determine more clearly the sources of suspected problems.

Objectives: To serve as the basis for specific remedies, and to isolate possible illegal discharges, specific accumulations of debris, excessive animal wastes, sewer line failures, or hazardous wastes which may be impacting surface runoff and special problem areas.

Description: The activities which can help isolate possible sources of problems for water quality problem areas identified in this Plan are indicated below. Each year, field survey and monitoring data should be reviewed to determine whether these problems still exist and whether others have developed.

a) Establish improved bacteriological ranges for County shellfish monitoring program. This program will help determine more clearly the bacteriological status of shellfish growing waters and any fluctuations due to surface runoff.

   Other efforts related to shellfish growing waters are suggested as alternatives for interagency efforts under Item E.

b) Conduct monitoring above and below suspected problem source on Frenchman's Creek. This will be an effort to determine whether a particular horse stable may be endangering fish resources.

c) Develop coordinated field survey or monitoring in San Pedro Creek watershed. There are many agencies which conduct creek inspections, field surveys and monitoring. Focusing agency attention in this watershed and coordinating data collection could help isolate any specific problem sources. This is also discussed as a program under Item E.

Measure D.2: Establish a program to solve documented problems.

Objectives: To develop a realistic, implementable program for identified problems.

Description: Some water quality problems can be solved by identifying particular sources and working to eliminate these. Measure D.1, above, will serve as the basis for such solutions.

Other problems have less specific sources. The many programs identified in this Plan for general debris and erosion should help improve these more diffuse problem sources throughout the County. Focusing those programs in the drainage areas of known water quality problems will be an additional aid. For these reasons this Plan has recommended two special programs for the lagoon areas in addition to existing city efforts in these locations. Additionally, streams on the coast will benefit in general from the special attention to runoff and erosion control. Other focused programs such as these will be developed based on further problem identification.

a) See Items A.3 (b) and B.2 (b), above for lagoon areas. Education efforts will be initiated in the lagoon areas; and a special Brisbane Lagoon watershed study will be conducted.

b) Continue implementation of the Foster City Lagoon Management Plan. Foster City must comply with the specifications of an NPDES permit issued by the Regional Water Quality Control Board. Their Lagoon Management Plan is being updated to help assure compliance.

c) Develop and implement other specific programs based on D.1, above, and Item E, below. As other problems are identified and suspected problems pinpointed more clearly, appropriate mitigation measures can be recommended.

Assessment: The assessment for these efforts is included in the discussion of Item E., Further Problem Identification and Control Measure Assessment, and in the discussion of other specific control measure activities.

2. GENERAL PLANNING ACTIVITIES

FURTHER PROBLEM IDENTIFICATION AND CONTROL MEASURE ASSESSMENT

Planning Activity

E. Further Problem Identification and Control Measure Development/Assessment

The recommended planning approach specifies that this Initial Plan should address the need for identifying priority problems more clearly, and assessing the suitability and effectiveness of control measures. Such information can serve as a basis for more site-specific recommendations and future Plan review and modification.

At present, numerous local, regional, State, and federal agencies are operating within San Mateo County to gather information and solve environmental problems. Their activities range from regular, ongoing monitoring of shellfish waters, bathing waters and streams by the County Environmental Health Office, to short-term monitoring and field surveys by CalTrans, California Fish and Game, and others. Table 10 provides some ideas of the existing efforts.

These efforts are not designed to be particularly effective in isolating or solving surface runoff or nonpoint pollution problems. For these reasons, the Plan recommends the following actions, initiated in Year One:

Measure E.1: Establish an interagency system to identify problems and related control measure recommendations.

Objective(s): To provide a more complete data system on possible problem areas; to provide specialized information on known or suspected problem areas; to provide assistance in determining and evaluating control measures for priority problems identified in this Plan.

Description: The agency interest in this measure is not known at present. For that reason, the following steps are recommended:

a) Establish a Technical Subcommittee of the 208 Steering Committee to guide development of system.

b) Establish a specific annual work program and general 5 year work program for interagency cooperation.

c) Implement work program.

The subcommittee would be encouraged to focus initial efforts on the specific problem sources, geographic problem areas and control measures addressed in this Plan. A proposed Year One work program and schedule for this Subcommittee's review are indicated on Table 11.

It should be noted that increased monitoring of storm water discharges may be necessary in the future under proposed EPA regulations. The coordinated agency approach outlined here may provide a cost-effective alternative to such monitoring. More useful information about a particular water quality problem could be developed by cooperative agency efforts in a particular watershed than by end-of-the-pipe monitoring in numerous locations.

TABLE 10

AGENCIES WITH EXISTING OR POTENTIAL FIELD SURVEY/MONITORING PROGRAMS IN SAN MATEO COUNTY

AGENCY	ACTIVITIES
Housing & Community Development (HCD)	- Field Work
Planning/Building	- Field Surveys
Public Works	- Drainage Maintenance District and Flood Control Zone Channel Inspections
	- Road Division Field Work
Environmental Health	- Bathing Water, Shellfish Bed, and Some Stream Monitoring
	- Channel and Stream Surveys (for Vector Control)
2. Cities (19)	- Storm Inlet/Stream/Channel Inspections
	- General Field Work
	- Treatment Plant Monitoring
3. California Fish & Game	- Stream Channel Surveys
	- Monitoring
	- Special Studies
4. Cal Trans	- Some Stream Monitoring
5. San Mateo County Mosquito Abatement District	- Stream and Channel Inspections
	- Storm Inlet "Inspection"
6. Resource Conservation District	- Field Surveys
7. U. S. G. S.	- Stream Monitoring
	- Special Studies
8. Regional Water Quality Control Board	- Bay Monitoring
	- Field Work
9. U.S. Army Corps of Engineers	- Field Surveys
	- Special Studies
10. Coastal Commission	- Field Work
11. B.C.D.C.	- Field Work
12. Groups and Institutions:	
Marine Ecological Institute	- Sampling Observations
Colleges	- Sampling Observations
Environmental Groups	- Sampling Observations

Proposed Work Program Alternatives:

The activities indicated in Table 11 are suggested for consideration by the proposed Technical Subcommittee. Not all of these actions could be accomplished in the Year One program, and other studies may be suggested by these agencies which are more timely. Some of the activities are already included in other sections of this Plan. They are repeated here since it is possible that supplementary actions by various agencies would be needed.

Schedule for Year One Program

By October, 1977

- o Agencies indicate level of interest and preliminary ideas for coordinated services in Action Plan worksheet.

By November, 1977

- o Present lead agency calls a meeting of agencies to discuss establishing a 208 Technical Subcommittee, and to determine preliminary work program and priorities.

By January, 1978

- o Depending on results of November meeting, summarize decisions into a work program, and begin implementation.

By June, 1978

- o Review and summarize preliminary findings and recommendations for further actions in an Interim Report.

By June, 1979

- o Evaluate Year One efforts in Plan update.

Assessment:

a) Environmental. If a coordinated data planning and service system is developed, problem identification and control measure assessment will be enhanced. Existing field survey and monitoring information collected by numerous agencies would be available to all to analyze persistent locations of debris, illegal discharges, or water quality degradation. Such information and analyses could reduce the need for field work by some agencies, reducing their costs or increasing the time available for solving the problems.

Coordinating agency work to focus on a particular problem area could help identify problem sources, and appropriate controls more effectively than isolated agency efforts.

Table 11 - Technical Subcommittee Work Program Alternatives

1.	Bayside Lagoons	o Agencies could assist in designing and evaluating the effectiveness of the pilot education program recommended in the Plan for the lagoon areas. A coordinated effort by local, regional or State agencies could be focused on field surveys, monitoring, and developing or distributing materials for this effort.
2.	Bayside or Coasts	o Agencies could assist the County in the Guadalupe Valley Area Study which will make recommendations affecting the Brisbane Lagoon watershed. The recommendation could affect siltation in Brisbane Lagoon.
2.	Bayside or Coastside Shellfish Beds Poss-ibly Affected by Surface Runoff	o In Year One, the County Environmental Health Office will be modifying their present monitoring program to pinpoint even more narrowly the ranges of bacterial levels in shellfish waters.
		o Assistance from other agencies in studying viral or heavy metals content of local shellfish would be beneficial.
		o Sewer line infiltration/inflow analysis efforts in one or more watersheds which drain to shellfish areas could help pinpoint possible bacterial sources.
3.	San Pedro Creek	o All agencies which can inspect or survey this creek, document in a common format any evidence of illegal discharges, hazardous wastes, general debris, locations of sewer line malfunctions, or excessive animal wastes.
4.	Frenchman's Creek	o County Environmental Health office will increase present monitoring to include areas above and below the suspected horse stable problem area. On the basis of their findings, a specific recommendation could be developed, if needed, by that office, the stable owner, California Fish and Game, and Half Moon Bay.
5.	Accumulations of Debris/Vehicle Wastes	o Agencies could assist the County Environmental Health Office and Public Works Departments in their now program to identify locations of hazardous wastes.
		o All agencies which conduct field surveys or inspections could agree to record the locations and possible sources of illegal discharges, hazardous wastes, general debris, sewer line malfunctions or excessive animal wastes in specific County watersheds or HCD target areas.

Table 11 Cont. - Technical Subcommittee Work Program Alternatives

6. Erosion/Siltation	o	All agencies which conduct field surveys or inspections could agree to record the locations and possible sources of significant erosion or siltation. Particular attention would be focused on the Coast.
	o	Agencies assist the County in the Guadalupe Valley Study. (See number 1, above).
7. Unidentified Problems	o	Agencies agree on a common reporting format for information on water quality problems.
	o	Agencies evaluate present monitoring efforts to determine if surface runoff or creek monitoring should be increased and where it would be most effective. This effort would supplement more specific problem-oriented monitoring or field surveys described above.

b) Social and Economic. This measure would affect the provision of public services. In the short-term, while organizing the program, regular agency services might be curtailed. In the long-term, however, services could be enhanced. To the extent that this leads to solving more environmental problems, public health and safety may be improved.

c) Institutional and Financial. The agencies or groups which could be affected by this system are those listed on Table 10. It is possible, however, that not all agencies would want to be regular members of such a Subcommittee.

This coordinated approach could improve agency services; but it is possible that additional reporting and meetings would place a strain on existing efforts. For that reason, this system would be optional for the affected agencies.

If the system is successful on a small scale during Year One, it could then be expanded.

There are two basic cost categories for such a system:

- o Establishing the Technical Subcommittee and studying the feasibility of cooperative efforts.

- o Implementing the system.

The costs for the first category are provided in the charts with a contingency fund for the second. Specific costs for the second category will depend on the selection of the Year One work program.

Some of the suggested options are already being funded by existing agencies. It is possible that outside funds could be sought to supplement these or other efforts.

Activities	Costs	Sources
Recommendation: E.1 - Problem Identification and Control Measure Assessment		
o Establish Technical Subcommittee (per meeting)		
- 208 Coordinator	16 hrs. x $19 = $ 304	208
- Technical Subcommittee*	4 hrs. x $24 x 32 = $3,072	Local
- Research Assistant	40 hrs. x $10 = $ 400	208
o Develop and Implement Work Program on feasibility, methods, funding coordinated system		
- 208 Coordinator	40 hrs. X $19 = $ 760	208
- Research Assistant	160 hrs. x $10 = $1,600	208
- Technical Subcommittee	4 hrs. x $24 x 32 = $3,072	Local
Subtotal	$9,208	
o Implement Pilot		
- Contingency	= $10,000	208
o Possible Total	$19,208	
*Any of the agencies indicated on Table 10		

CONTINUING PLANNING

Planning Activity

F. Continuing Planning Process

The approved planning approach emphasizes that continued study will be needed to identify problems and appropriate solutions, and that outside funding sources will be needed to help with this process. An annual review and update of the Plan is to be provided.

Measure F.1: Establish and implement procedures for annual review and update of the Plan.

Objectives: To assure timely review and update of the Plan each year to conform with Section 208 requirements of the National Water Pollution Control Act (1972).

Description: The following schedule and procedures are recommended:

a) General Schedule. Annual review and update of the regional Environmental Management Plan is required by the National Water Pollution Control Act Amendments (1972). Annual review of the County Runoff Plan is a part of that larger effort. It is anticipated that such review on the regional level will be targeted for June of each year. A local review process beginning no later than March of each year is therefore recommended.

For Year One of the Initial Plan, an interim update of the Plan is recommended for 1978. This would include progress evaluation, transition to a lead agency, and testing of continuing planning procedures while funding is still assured.

b) Procedures. The following procedures are suggested for use by the lead agency (see Section 2, below).

- o By March of each year, lead agency prepares an evaluation worksheet (Action Plan) for distribution.

- o By April of each year, request affected agencies to submit an evaluation of the program on an Action Plan worksheet.

- o By May of each year: 1) lead agency summarizes findings, distributes the summary to affected agencies, and calls a meeting to review findings, 2) a meeting of affected agencies is held to review the evaluation and determine the specific work program for the following year and a general outline of work for five years.

- o By June of each year, the work program for the following year is drafted, printed, and distributed for local modification and/or approval in thirty days.

Measure F.2: Establish a Lead Agency.

Objectives: To help assure continued coordination and implementation of the Plan and to accomplish annual review and update of the Plan.

Description: For this initial planning study, the San Mateo County Planning Division has acted as lead agency. This status is expected to continue through June, 1978, at which time the County's agreement with ABAG officially terminates. A determination of who will be responsible for coordinating the annual plan update and plan implementation processes after that time must be made.

This section outlines two basic options for such future arrangements and recommends a schedule and process for making this decision. These options are not necessarily mutually exclusive; each is designed to work separately or as an element of the other. A combined approach could very likely be a preferred alternative if some financial mechanism were developed to decrease the burden on any one agency. If some cost sharing mechanism is acceptable to local jurisdictions it is recommended that the County Planning Division continue as Lead Agency with an advisory 208 Steering Committee. Staff in the Planning Division could provide staff support and interagency coordination under the auspices of the Regional Planning Committee (RPC), and ongoing planning efforts.

(a) Establish a Process and Schedule for Determining a Lead Agency: The following is recommended:

By October 1977

- Affected agencies indicate preferences for Lead Agency options in local Action Plan.

By November, 1977

- Present lead agency calls a meeting of agencies to discuss options. Recommendations determined and sent to affected agencies for comment.

By January, 1978

- Agency comments received and summarized in a report to the County Board of Supervisors.

By February or March, 1978

- Board of Supervisors requests implementation of either lead agency option or a combination of the two, based on local agency preferences.

By April, 1978

- o Transition to selected lead agency option begins as does interim plan review and update process.

By June, 1978

- o Transition to selected lead agency and interim plan update process are completed.

(b) Determine a Lead Agency. The following options are provided for local review and possible modification.

Option 1. 208 Steering Committee.

Objectives.

- o To help form a base of cooperative interagency efforts for continued planning and implementation.
- o To distribute the burden of the 208 Continuing Planning process among all affected jurisdictions.

Description

a) Candidate Agencies. This Steering Committee would be composed of ten core San Mateo County agency representatives, and an advisory panel of other agencies or individuals. The core representatives would include one representative each from: County Manager's Office, Department of Environmental Management (Planning Division), County Public Works Department, County Environmental Health Office, the Resource Conservation District, Mosquito Abatement, and four city staff representatives selected by the City Manager's Association.

The advisory panel would include: other cities and districts not represented, the Regional Planning Committee, representatives of environmental or civic group(s) selected by the Board of Supervisors, and members of the proposed Subcommittee on Problem Identification and Control Measure Assessment. (See Section E).

b) Function. The Committee would serve to update the Plan, coordinate implemention; and identify an appropriate problem identification process for the Year One Program (See Section E).

c) Operation. The Committee would select a chairman from the core group each year to coordinate the Plan update process and work efforts. Review and update would include any needed changes in the Steering Committee.

Assessment:

a) Environmental. With agencies working together more regularly to solve mutual problems, indirect environmental benefits could be expected. Mutual program planning and data management could help to solve some problems which individual agency efforts are unable to meet.

b) Economic and Social. Indirect impacts on the provision of governmental services could be expected. In the short term, the agency selected as "chairman" might have some difficulty meeting all regular agency commitments while preparing the plan update.

c) Institutional and Financial. See Costs and Financing mechanisms.

Option 2. Single Permanent Agency.

Objectives

o To provide continuity from year to year in terms of knowledge, responsibility, and records.

Description

a) Candidate Agencies. A single permanent agency could be selected from among any which have Countywide responsibilities. Likely candidate agencies are those within County government: Board of Supervisors/County Manager, Environmental Health, Public Works, and/or Environmental Management (Planning Division).

b) Function. The agency would update the Plan, help coordinate implementation, and be a permanent site for records.

Assessment:

a) Environmental. A consistent lead agency coordinator could help assure adequate record keeping, and familiarity with Countywide problems and existing or possible solutions. A single agency, however, would need the financial support and assistance of others to have an effective plan update process.

b) Economic and Social. Possible loss of service time of an agency could have negative social impacts. The increased public identity of the program afforded by one agency could be beneficial for the public's sense of community.

c) Institutional and Financial. See Financing mechanisms.

Measure F.3: Establish Financing Mechanisms.

There are three basic cost categories for the Continuing Planning Process:

- o Costs of establishing a Continuing Planning Process. These costs will be offset by remaining 208 funds through June, 1978.
- o General costs for the annual review and update of the Plan. (These are the costs associated with meeting the requirements of Section 208 for setting new goals and assessing progress.)
- o Detailed costs of further planning, implementation, and assessment. (These are the costs for each jurisdiction for continued study, implementing changes to services, and assessing the results of control measures.)

These costs are discussed below:

a) Establish local cost-sharing mechanisms for annual update.

The cost of annual update will probably have to be assumed by local affected jurisdictions. Through June, 1978, such costs can be funded by remaining 208 funds and local agencies. After that time, the cost for annual Plan update is proposed to be shared by all affected jurisdictions. Such costs, shown on the charts, would be approximately $300 per jurisdiction, which includes $200 for distribution to a lead agency, attendance at meetings, and Action Plan responses. Such costs could possibly be scaled according to size of city rather than equal shares.

b) Determine specific cost and financing mechanisms for each annual work program.

The detailed costs of further studies, implementation and assessment have been estimated for Year One (and primarily through June, 1978) in previous sections of this report.

To the extent that such Continuing Planning work can be incorporated into existing agency efforts through the proposed Steering Committee and its Technical Subcommittee, such costs may be minimal. The Steering Committee could serve to focus existing services and their costs to solve mutual problems without significant financial burden. If this is not possible, a cost of about $550 per year might be needed from each jurisdiction. (Table 3)
Implementation of some control measures may impose additional financial costs. It is presumed that until problems and

control measure effectiveness are better known, such implementation will be a matter of local discretion based on resources and perceived multiple benefits.

Some measures could potentially be funded with outside sources. For the Year One Program these have been identified. Such sources should be identified for subsequent detailed annual work programs as part of the annual update and review procedure.

Activities	Costs	Sources
Recommendation: F.1 a Continuing Planning Process		
o Local Action Plan response on lead agency selection, financial arrangements	4 hrs. x $24 x 25*= $2,400	Local
o Summary of Findings		
- 208 Coordinator	4 hrs. x $19 = $ 76	208
- Research Assistant	20 hrs. x $10 = $ 200	208
o Meeting of agencies		
- Local agencies	2 hrs. x $24 x 25 = $1,200	Local
- 208 Coordinator	4 hrs. x $19 = $ 76	208
o Local agency response and report to Board		
- Local agencies	2 hrs. x $24 x 25 = $1,200	Local
- Research Assistant	16 hrs. x $10 = $ 160	208
- 208 Coordinator	10 hrs. x $19 = $ 190	208
- Secretarial	8 hrs. x $7 = $ 56	208
o Transition to lead agency		
- Agency	40 hrs. x $24 = $ 960	208
- 208 Coordinator	40 hrs. x $19 = $ 760	208
o Total	$7,278	

* Includes: County Offices - Environmental Management (Planning) Public Works, Environmental Health Office, Manager's Office Cities - 19, Other - Mosquito Abatement District, Resource Conservation District.

Activities	Costs	Sources	
		June 1978	June 1979
Recommendation: F.2 Cost of Interim and Annual Update			
o Lead agency prepared Action Plan Worksheet	40 hrs. x $24 = $ 960	208	Local
o Local Agency Action Plan Response *	4 hrs. x $24 x 25 = $2,400	208 or Local	Local
o Lead Agency Summary and Distribution	40 hrs. x $24 = $ 960	208	Local
o Meeting of proposed 208 Steering Committee**	4 hrs. x $24 x 10 = $ 960	Local	Local
o Annual Work Program drafted, printed, distributed (Lead Agency)	40 hrs. x $24 = $ 960	208	Local
o Investigation of outside funding sources for activities Lead Agency	80 hrs. x $24 = $1,920	208	Local
o Total	$8,160		
Additional Costs for Lead Agency	$ 4,800		
Cost per jurisdiction	$ 96		
Possible share of lead agency costs/jurisdiction,	$ 192		
Total cost/jurisdiction	$ 288		

* All cities, four County offices (Manager, Environmental Management, Public Works, Env. Health) & two others (Mosquito Abatement; Resource Conservation District).

**A core group of 10 agency representatives.: County Offices - Manager's Office, Environmental Management (Planning Division), Public Works, Environmental Health. Cities - Four representatives Other - Mosquito Abatement; Resource Conservation District

DOCUMENTING LOCAL PRACTICES

Planning Activity

G. Documenting Existing Practices

In San Mateo County there are many existing practices or projects which help control surface runoff pollution or generally improve water quality.

Tables 12, 13, 14 indicate some of the present efforts which have benefits for water quality. Most of these programs are undertaken for reasons other than water quality. While the level of operations is high, the effectiveness of these activities for water quality is difficult to assess.

Substantial investments are also being made to upgrade sewage treatment facilities with very significant benefit to water quality.

While information on other runoff-related practices was acquired during the course of this study, all of this information has not been included in this report. The sources of and solutions to surface runoff are so varied that an adequate description of all related activities would almost be a compendium of urban and rural public works and planning services.

For these reasons the Plan recommends the following:

Measure G.1: Establish a program to document local surface runoff related practices and projects and evaluate effectiveness of measures.

Objectives: To develop model approaches or best management practices for surface runoff control; to determine areas of possible interjurisdictional cooperation; to assess program progress; and to direct future planning efforts.

Description: This measure would consist of the following:

a) Develop an annual Action Plan worksheet to direct local documentation efforts.

b) Implement documentation program.

The effort to document local practices should be directed primarily to determining the most or least effective elements of local practices for use in developing model approaches. For this reason documentation efforts should be directed to annual Year One program needs. Documenting other local practices would be optional.

The means for such documentation will include a local Action Plan Worksheet and findings of special task forces, or special studies. The Action Plan Worksheet for the Year One Program (1977-1979) is indicated here and in the cover letter for this Plan.

The information from these worksheets will be analyzed by lead agency staff and the proposed 208 Steering Committee to develop model approaches to runoff control and possible cooperative actions.

A new worksheet would be prepared each year as part of the annual plan update.

Assessment: The assessment for the Year One documentation effort has been included as a part of each control measure in this Plan. Costs of this activity for the first year can be billed against remaining County 208 funds on an optional basis.

Table 12 - STREET SWEEPING PRACTICES (1977)

Agency \ Control Measure	Frequency: Res.	Frequency: Comm.	Frequency: Ind.	Frequency: Other	Areas not covered by Agency	Interagency or Other Arrangements for Sweeping	Equipment: Type	Equipment: #	'76-'77 Costs (Approx.)	Means of Minimizing Vehicles When Sweeping	Expected Program Changes	Comments
Atherton			N/A		Unimproved Areas							
Belmont	1X /wk.						Broom Vacuum	1 1				
Brisbane												Purchase of sweeper next
Burlingame	1X /wk.	6X /wk.	1X /wk.				Mobil Broom	2	$ 84,000	Parking Restrictions		
Colma	1X /month					County Contract				No on-St. Parking		
Daly City	1X /2 wks	1X /day	N/A		Private Commercial lots	None	Broom		$ 58,900	Pilot Parking Reg. Study		
Foster City	1X /2 wks	3X /wk.	N/A		None	None	Mobil				None	
Half Moon Bay	1X /wk.	1X /day	N/A		Unimproved Areas							
Hillsborough			N/A		Unimproved Areas							Manual Cleaning
Menlo Park	1X /wk.	5X /wk.	1X /wk.	1X /wk.	None	Caltrans	Broom	2		Parking Restrictions		
Millbrae	1X /wk.	1X /day		Lots/Alleys 1X /wk.	Private Lots	Caltrans	Broom	2	$ 46,000			
Pacifica	1X /2 wks	1X /2 wks	N/A		Arterials	None	Broom	1			None	Manual Cleaning
Portola Valley			N/A	3X /yr.	Unimproved Areas	County Public Works						
Redwood City	1X /2 wks	3X / wk.				Caltrans	Broom		$ 80,725			
San Bruno	1X /wk.	1X /day	1X /day				Broom	2				
San Carlos	1X/3-4wks	1X /day		Lots 1X /wk.			Broom	1				Purchase of Vacuum soon
San Mateo	1X/2 wks	1X /day						2				
So. San Francisco	1X /wk.	5X /wk.	1X /wk.	Lots 1X /wk.	None		Broom Vacuum	3 1	$103,020	Parking restrictions	None	Manual Cleaning
Woodside			N/A		Unimproved Areas							Manual Cleaning
County Roads: General East Palo Alto				1X/3-4wks 1X /2wks	Unmproved		Vacuum Broom	1 1	$ 79,200			

TABLE 13 - STORM INLET OR CATCH BASIN CLEANING (1977)

Agency \ Control Measure	Frequency					Methods			Prevention (See Litter/Dischrg.)		Type of Inlet	Comments
	Once a Year	Once every 3 months	During & After Storms	Year-round; as needed; "periodic"	Months of greatest effort	Vacuum	Manual	Sewer Nozzle	Grates/ Bars at Inlets	Education		
Atherton			x				x					
Belmont			x	x					x		Storm Inlet.	EDA Grant Application
Brisbane				x								
Burlingame			x	x	Rainy Season		x				Catch Basin	
Colma				x			x					
Daly City	x			x 1X/2 wks		x						
Foster City	x				April-Sept.		x		x	x		
Half Moon Bay	x				Before Raines							
Hillsborough	x			x								
Menlo Park				x			x					
Millbrae	x			x								
Pacifica				x								
Portola Valley			x	x			x		x		Catch Basin Storm Inlet.	
Redwood City	x		x		Fall		x	Chase Water		x		
San Bruno	x		x	x	Fall		x					
San Carlos				x			x					
San Mateo				x								
So. San Francisco		x		x			x				Catch Basin	Proposed VAC-OL
Woodside	x				Sept. - Oct.							Few catch basins; hire County
Co. Public Works	x		x		Fall							

* This table will be corrected and updated during local review of the Draft Plan, September 1977.

Table 14 - STORM DRAIN/CHANNEL/STREAM CLEANING PROGRAMS (1977)

Control Measure / Agency	Cleaning Frequency: Once/Yr.	Periodic	During/After Storms	Months of Greatest Effort	Inspection: Freq.	Time of Yr.	Methods: Dred-ging	Man-ual	Cable/Bucket	Notice to Owners	Other	Prevention: Education/Info Programs	Comments
Atherton	X		X		Annual			X					Property Owners Responsible
Belmont													
Brisbane							X						
Burlingame	X												Property Owners Responsible
Colma		X			Periodic			X					
Daly City		X		Fall		Fall							
Foster City		X	X	Apr.-Nov.	Wkly		X	X				X	
Half Moon Bay		X						X					
Hillsborough		X			Annual	Fall				X			Plan use of CCC Help
Menlo Park	X	X	X										Silting Basins Required
Millbrae													
Pacifica		X		Winter	Periodic			X					
Portola Valley		X											Property Owners Responsible
Redwood City	X											X	
San Bruno	X							X					Few Open Drains
San Carlos	X			Summer									
San Mateo		X			Annual		X	X	X		Volunteers	X	
So. San Francisco	X		X	October	Periodic	Aug.-Sept.	X	X					
Woodside					Annual					X	Volunteers		Property Owners Responsible
Mosquito Abatement					Annual								
County Health					Annual								
Co. Public Works	X				Annual					X			
Other													

* This table will be corrected and updated during local review of the Draft Plan, September 1977.

San Mateo County
208 Action Plan
Worksheet
Initial Surface Runoff Plan

This Action Plan worksheet is provided to help local jurisdictions respond to the recommendations in the Initial Plan, and to provide specific information for the Year One Program.

This worksheet follows the general outline of the Plan. Each question is optional. Please respond on a separate sheet.

Cost commitments may require additional time for completion. Please complete what you can by October 12, 1977.

The time spent in completing this worksheet can be charged against 208 planning funds. Call Geri Farman, 208 Coordinator, for details.

Topic A: Control Measures for Initial Plan.

1. Does your jurisdiction agree with the general problem priorities indicated in the Plan? See Section II.A., page 16 .
   If not, what are your recommendations?

2. Does your jurisdiction agree with the general control measure activities specified for the Initial Plan? See Table 7 , page 28.
   If not, what are your recommendations?

Topic B: Year One Program

1. Does your jurisdiction agree with the selection of specific control measure activities for the Year One Program? See Table 7 , page 28 .
   If not, what are your recommendations?

2. Does your jurisdiction agree with the general planning activities for the Year One Program?
   If not, what are your recommendations?

Topic C: Specific Needs for the Year One Program. The following questions are organized according to specific Year One Program recommendations. The information will be used to develop model approaches to existing practices and to determine the best procedures for problem identification, documentation of practices, and continued planning.

Recommendation A.3. Establish a prevention program (See page 39).
*To be completed by all jurisdictions.

1. Is your jurisdiction willing to participate in a public education program designed to reduce the accumulation of pollutants?
   o If so, would you be able to expend any time or funds on such an effort? To what extent?

2. Please describe your present (or proposed) litter or dumping prevention program, including all or some of the following:

- o An assessment of those program elements that have been the most and the least successful.

- o An assessment of activities you believe would make your program more effective.

- o Present ordinances and enforcement procedures.

- o Present educational efforts.

- o Present home garbage, garden waste, public trash can, and recycling efforts and costs.

- o Proposed program changes.

3. Is your jurisdiction interested in encouraging oil recycling?

Recommendation A.5. Establish a program to improve the water quality benefit of existing street sweeping programs in San Mateo County. * (To be completed by jurisdictions which have or are considering street sweeping programs.)

Please describe your present (or proposed) street sweeping program, including all or some of the following:

1. Details on your program not included in Tables 12, 13, 14.

2. An assessment of what could help your jurisdiction maintain or develop high levels of service.

3. An assessment of whether cooperative street sweeping services are desirable for your jurisdiction, any experience or recommendations you have regarding such arrangements (CalTrans, or other); whether you could expend any time or funds to develop such a program.

4. An assessment of whether on-street parking during sweeping can be minimized; any experience or recommendations you have on successful techniques; whether you could expend any time or funds to develop a parking program.

5. An assessment of whether new equipment for fine particle pickup (vacuum units) would be desirable for your jurisdiction; any experience or recommendations you have regarding such equipment and whether you could expend funds for vacuum units.

6. An assessment of whether sweeping services can be increased (or maintained) during the rainy season; any experience or recommendations you have on successful techniques; and whether you could expend any time or funds to develop such a program.

Recommendation B.2. Develop a program to identify possible improvements to existing erosion and runoff control practices in the unincorporated Coastal area.

* To be completed by County departments, Resource Conservation District, Farm Advisor, Brisbane and interested others.

1. What improvements or supplements to existing County erosion or runoff controls or management does your agency feel are needed?

2. Would your agency be able to expend time or funds to help develop such improvements?

3. What erosion and runoff controls or enforcement procedures do you believe are most effective?

Recommendation D.1. and D.2. Determine more clearly the sources, extent, and severity of special problem areas. (See page 62 .)

* To be completed by County departments, Pacifica, Half Moon Bay, Redwood City, Foster City, San Mateo, Burlingame, Brisbane and interested others.)

1. Is your agency able to expend time or funds to develop an interagency program for further problem identification and planning in special areas identified in this report? If so, to what extent?

2. Do you agree with the recommended actions?

Recommendation E.1. Establish an interagency system to identify problems and related control measure recommendations. (See page 67 .)

* To be completed by all jurisdictions.

1. Is your agency able to expend time or funds to develop such a system? If so, to what extent?

2. What preliminary recommendations do you have on work program priorities? (See Table 11 , page 70).

Recommendation F.1. Establish and implement procedures for annual review and update of Plan. (see page 75).

* To be completed by all jurisdictions.

1. Are the suggested schedule and procedures satisfactory? If not, what are your recommendations?

Recommendation F.2. Establish a Lead Agency.

* To be completed by all jurisdictions. (See pages 76-78.)

1. Which lead agency option does your jurisdiction prefer? If none suggested in the Plan is satisfactory, what is your recommendation?

Recommendation F.3. Establish financing mechanisms. (See pages 79-82.)

* To be completed by all jurisdictions.

1. Is your jurisdiction willing to participate in an annual plan update procedure? If so, is your jurisdiction willing to transfer approximately $ 200 to a Lead Agency?

Recommendation G.1. Establish a program to document local surface runoff related practices and evaluate effectiveness of measures.

1. Do you feel that this worksheet is an effective way to document local experience with specific control measures? If not, what are your recommendations?

2. What other practices or projects are you implementing or planning which you feel should be documented.

3. Please double check Tables 12,13,14 and provide additional information as needed.

III
APPENDICES

APPENDIX A

GENERAL PLANNING DOCUMENTS

Appendix A

General Planning Documents

Included in this appendix are the following:

1. San Mateo County Surface Runoff Plan Goals and Objectives.

2. Proposed Planning Approach.

3. Proposed permit program for the National Pollutant Discharge Elimination System.

1. Proposed Goals of the San Mateo County Surface Runoff Plan*

The goal of the Runoff Plan is to develop a reasonable management plan agreeable to local communities and jurisdictions and to maintain or improve surface water quality in and around San Mateo County. Emphasis in the Plan will be on existing problems and the beneficial uses of San Francisco Bay; of land-based surface waters within or affected by San Mateo County; and Pacific Ocean waters bordering San Mateo County. The Runoff Plan is to be developed taking into cognizance other vital needs which exist in San Mateo County and social, economic, and environmental constraints of affected jurisdictions. The Plan will be an initial plan from which a more comprehensive plan may subsequently evolve in a continuing planning process.

Proposed Objectives

The objectives of the Runoff Plan are:

1. Describe and evaluate the existing and potential impact of surface water runoff on beneficial water uses, with emphasis on existing impacts of the urban runoff.

2. Describe and evaluate existing efforts to maintain and improve water quality and beneficial uses.

3. Identify and evaluate alternative methods for maintaining or improving water quality and beneficial uses.

4. Provide maximum opportunity for participation by affected jurisdictions and the public in the evaluation of alternatives, selection and refinement of the Runoff Plan.

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* Taken from Examination of Existing Water Quality Problems in San Mateo County, Progress Report No. 9 to ABAG, San Mateo County Planning Division and PBQ&D, Inc., April 19, 1977.

2. Proposed Approach to San Mateo County Surface Runoff Plan

The San Mateo County Runoff Plan will consist of two basic programs: an Initial Plan, to be prepared for the city and district review by July 31, 1977 transmitted to ABAG in working draft by August 31, and in final version by October 12, 1977; and a Continuing Planning Process which will be an outgrowth of this Initial Plan.

The following highlights the proposed components of these two programs.

I. <u>INITIAL PLAN</u>

A. <u>Planning Concepts</u>

- o RECOMMENDED CONTROL STRATEGIES FOR SURFACE RUNOFF SHOULD VARY BY THE LEVEL OF INFORMATION ABOUT THE SEVERITY OF SURFACE RUNOFF PROBLEMS.
- o CONTROL STRATEGIES SHOULD EMPHASIZE LOCAL OPTIONS FOR SOLVING RUNOFF PROBLEMS WHEREVER POSSIBLE.
- o CAREFUL DOCUMENTATION OF LOCAL EFFORTS AND PROBLEMS IS ESSENTIAL FOR PLAN FORMULATION, EVALUATION, AND FUTURE MODIFICATION.

B. <u>Planning Strategies</u>

Two core control strategies are recommended for this Initial Plan:

1) Baseline <u>or</u> "No Problem" Strategy; The first strategy would call for careful Documentation of Existing or Planned Control Practices and Projects which serve to mitigate potential surface runoff quality problems. This documentation will be a minimal effort for all affected jurisdictions in San Mateo County.

2) "Estimated Problem" Strategy: The Initial Plan will identify problems or conditions on the land, stormwater system or receiving waters which may be associated with surface runoff quality. These problems have been determined through computer modeling or a survey of local, regional or state agencies. While these problems are not completely understood, they can be addressed in the Initial Plan. For these "estimated problems," the following strategies will be recommended:

a) Wherever possible, these "estimated" problems will be ranked in terms of regional and local priorities for further investigation or action. (If information on regional priorities is not available in time for the preparation of the Initial Plan Draft, such priorities may have to be considered in the Continuing Planning Process, outlined below.) The level of concern for a problem will also be identified for each priority problem; that is, whether the problem is of regional, countywide, watershed, district, city or special area interest.

b) The Initial Plan will identify a planning process and timetable for more clearly identifying the priority problems, their possible source(s), and specific measures appropriate to these problems. This "process" will form the nucleus of the Continuing Planning Process.

c) Where an "estimated problem" appears to have shorter term, "no cost," "low cost," or "offsetting cost" activities which could mitigate the problem, these will be identified in the Initial Plan. Those jurisdictions or areas where such activities could be effective will also be identified. Such "activities" could include refinements to existing practices, demonstration projects funded by outside sources, interjurisdictional cooperation in provision of services, or activities which increase some service costs while decreasing others. Where interjurisdictional cooperation would be needed, a process and timetable for further feasibility study and/or implementation will be outlined.

C. Planning Format

The planning strategies outlined above--are realistic approaches to the Surface Runoff plan to the extent that local jurisdictions are willing to respond to them in a manner which permits plan evaluation in the future. The following is recommended as a means for this response:

Each affected jurisdiction would be asked to prepare a brief ACTION PLAN which outlines their response to the strategies in the Initial Plan which apply to them. This response should reflect other vital needs in San Mateo County and the social, economic and environmental constraints of affected jurisdictions. This Action Plan would include the following:

a) By October 12:

1) Verification and further documentation of existing practices

2) Indication of those single-jurisdiction, no cost

items which they are willing or able to undertake, and, if possible, a timetable for such activities.

3) For multi-jurisdictional efforts or continuing planning process proposals, completion by affected jurisdictions of a checklist of preferred processes and timetables for cooperative actions.

b) By June, 1978:

1) Submittal of any minimal or offsetting cost items which a jurisdiction is able to adopt.

2) Verification of commitment to an identified continuing planning process or cooperative interjurisdictional activities (for relevant jurisdictions).

II. CONTINUING PLANNING PROCESS

A. Planning Concepts

- CONTINUED STUDY ON THE LOCAL AND/OR REGIONAL, STATE, NATIONAL LEVELS WILL BE NEEDED TO REFINE AND VERIFY ESTIMATED SURFACE RUNOFF PROBLEMS AND GENERALIZED CONTROL MEASURES.

- SPECIAL INVESTIGATIONS WILL BE NEEDED TO FURTHER IDENTIFY SPECIFIC WATER QUALITY PROBLEMS IN RECEIVING WATERS, AND TO IDENTIFY ACTUAL PROBLEM SOURCES AND APPROPRIATE SOLUTIONS.

- REGIONAL, STATE AND NATIONAL INVOLVEMENT WILL BE NEEDED TO PROVIDE TECHNICAL SUPPORT, FUNDING, INTERCOUNTY COORDINATION, AND EDUCATION; BUT LOCAL PARTICIPATION BY AFFECTED JURISDICTIONS IS NEEDED TO PROVIDE DIRECTION FOR SUCH ASSISTANCE.

B. Planning Strategies

1) The first strategy would be to identify PRIORITIES for further study. This activity would be done on a preliminary basis in the INITIAL PLAN. Review of the plan on the regional, state or other levels may indicate alterations in these priorities.

2) The second strategy would be to invite local affected jurisdictions to participate in short-lived task force(s) to identify a preferred process for further study; and to identify whether outside technical expertise and/or funding is needed. Similarly, regional agency ideas would be solicted wherever a problem may affect a regional resource. Pilot projects, grant applications, local or Bay Area research may be recommended.

3) The third strategy would be to outline a specific ACTION PLAN for the priority problem which incorporates the local and, where needed, regional concepts.

4) The fourth strategy would be to annually update the local action plan. This updating would include:

--documenting local efforts and experiences with recommended control measures

--meetings to share local information and to be informed by regional or other sources about new research findings

--modifying local action plans to reflect new information

C. Planning Format

1) The local ACTION PLAN for the continuing study efforts which are needed would be completed by June 1978.

2) The ACTION PLANS for each jurisdiction would be updated annually by June of each year.

3) The responsibility for coordinating the updating process would be shared by County and regional personnel.

6/21/77

3. Proposed Permit Program for the National Pollutant Discharge

[40 CFR Part 125]

[FRL 680–7]

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Extension of Comment Period

This notice extends the period for comments to the notice, published November 29, 1976 (41 FR 52308), proposing certain amendments to the notice requirements and hearing procedures for the issuance of National Pollutant Discharge Elimination System (NPDES) permits under section 402 of the Federal Water Pollution Control Amendments of 1972. (86 Stat. 816 et seq., 33 U.S.C. 1251 et seq.)

Requests for an extension of time were submitted by several interested persons and groups, including the National Association of Electric Companies, the Natural Resource Defense Council and the American Bar Association, Section of Administrative Law, Environmental Quality Control Committee. Most of the commenters requested that the period be extended at least 30 days, although Natural Resource Defense Council requested only a 14-day extension. The requests generally argued that additional comment time is necessary to review and consider the nature and implications of several significant proposed changes.

The Environmental Protection Agency has decided that extending the comment period would encourage careful consideration of the proposed regulations, resulting in comments more useful to the Agency in its evaluation thereof, and that a reasonable extension of the comment closing date is five weeks from the existing (January 33, 1977) date. The comment period is hereby extended, and all comments received on or before March 1, 1977, will be considered.

Dated: January 28, 1977.

STANLEY W. LEGRO,
Assistant Administrator for Enforcement.

[FR Doc 77-3444 Filed 2-3-77;8:45 am]

[40 CFR Parts 124 and 125]

[FR 672-4]

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

General Permit Program

On July 5, 1973, the Environmental Protection Agency (EPA) published amendments to 40 CFR Part 125, the regulations establishing policies and procedures for the issuance of National Pollutant Discharge Elimination System (NPDES) permits by the Federal government (38 FR 18000). These amendments excluded discharges from small concentrated animal feeding operations, separate storm sewers, and certain agricultural and silvicultural activities from the requirement of applying for and obtaining a permit. On that date EPA also amended 40 CFR Part 124, Guidelines for State Program Elements Necessary for Participation in the NPDES, by adding a new § 124.11. This section authorized States participating in the NPDES to make the same exclusions from the permit requirement as provided for in the amended Part 125 regulations. However, the EPA Regional Administrator or the Director of a State water pollution control agency could override these exclusions by identifying individual sources as significant contributors of pollution and requiring such sources to apply for and comply with NPDES permits. (See 40 CFR 124.11 and 125.4.)

The Natural Resources Defense Council (NRDC) challenged this exercise of the Administrator's discretion to exclude certain point sources from the NPDES permit program in a lawsuit filed in the Federal District Court for the District of Columbia. The District Court ruled in favor of NRDC ("NRDC v Train", 396 F. Supp. 1393, 7 ERC 1881, (D.D.C. 1975)) and on June 10, 1975, issued a final order requiring EPA to propose and promulgate regulations "extending the NPDES permit system to include all point sources" in the concentrated animal feeding operation, separate storm sewer, agriculture and silviculture categories. EPA is appealing this decision.

However, in compliance with the court order, EPA has promulgated final regulations for concentrated animal feeding operations and separate storm sewers on March 18, 1976; for silvicultural activities on June 18, 1976; and for agricultural activities on July 12 1976. These promulgations eliminated the previous exclusions of certain categories of point sources from the NPDES permit program as administered by EPA and the States. In the regulations for concentrated animal feeding operations and silvicultural activities, the conventional NPDES permit program was applied to a limited number of identified point sources in those two categories. States administering the NPDES program must also apply the conventional permit program to these two categories. In the regulations for separate storm sewers and agricultural activities, however, EPA indicated that the NPDES permit program as currently administered was not appropriate to deal with the vast numbers of point sources in those categories. Instead, EPA today proposes a new program of general permits to cover point sources in the separate storm sewer and agricultural activities categories. In the separate storm sewer category, these point sources have been defined as conveyances or systems of conveyances located in an urbanized area and primarily operated for the purpose of collecting and conveying storm water runoff. In the agricultural activities category, these point sources have been defined as conveyances carrying surface irrigation return flow as a result of the controlled application of water by any person to land used primarily for crops. (40 CFR 125.52(a) (1); 41 FR 28493, July 12, 1976.) NPDES States may choose to administer a similar general permit program for the point sources in these two categories, or may apply the conventional individual permit program to separate storm sewers and agricultural poin sources.

This general permit program is intended to provide maximum flexibility to EPA and the States in administering an appropriate permit program for these categoires. This program specifically recognizes that pollution reduction from sources in these categories is often more effectively achieved by using best management practices (BMPs) than by applying end-of-pipe pollution contro technology. BMPs are managemen techniques that reduce the amount o pollutants at their source rather tha remove them from their point of discharge into navigable waters. The Federal Water Pollution Control Ac (FWPCA), however, contemplated tha NPDES permits would generally regulat pollution from point sources by imposin effluent limitations achieved by end-of pipe pollution control technology. It appears that under the FWPCA, BMPs t achieve pollution reduction and wate quality standards can be imposed as requirements in NPDES permits only i limited, specified circumstances,. Clearly however, BMP requirements may be imposed in permits so as not to conflict wit provisions of an areawide waste management plan approved pursuant to sectio 208. Moreover, BMPs may be imposed b requirements of State certification of a EPA-issued permit under section 40 Despite the flexibility offered by section 208 and 401, however, BMPs are generall not available as control mechanisms i NPDES permits at this time, althoug they are often the most effective mean of achieving pollution control for discharges from separate storm sewers an agricultural point sources.

Even if BMPs were more available a control mechanisms in NPDES permit much research is yet to be completed t develop and demonstrate the effectiveness of alternative management practice in all locations. For example, althoug more than $5.2 million has been expended for current research projects t control irrigation return flow aspects agricultural pollution, it is apparent th there are no BMPs which are universal applicable. Also, although more tha $350 thousand per year has recently bee spent for stormwater problem definitio and research and development, EPA not prepared to impose uniformly appli cable BMP requirements on all communi ties with stormwater pollution problem Instead, BMPs must be tailored to th specific area which they serve, takin into consideration local variations geography, geology, meteorology, rainfall, topography and crop productio Thus, the selection and implementati of BMPs are best achieved locally, coordination with 208 and other planning and field agencies.

These 208 plans, mandated by sectio 208 of the FWPCA, provide for local pa ticipation in the development and impl mentation of continuing areawide was treatment management plans to de effectively, in an integrated manner, wi both point and nonpoint sources of poll

tion. It appears, therefore, that the most effective mechanism for controlling pollutant discharges from point sources in the separate storm sewer and agricultural activities categories will be a combination of the general permits and the 208 plans and the regulatory programs designed to implement them. Thus in these regulations a program is proposed which utilizes to the fullest extent the local expertise and public participation provisions of the 208 planning process.

Given the variable nature of pollutant discharges from separate storm sewers and agricultural point sources, and the inability to impose nationally applicable substantive requirements at this time, most first generation general permits will authorize current discharges. However, a failure to develop and implement adequate 208 plans may compel more substantive restrictions in second generation general permits or in individual permits, which could include conventional effluent limitations, management practices, or other appropriate requirements.

Because of the interrelationship between this general permit program and the 208 planning program, the importance of comprehensive, sound and effective 208 plans cannot be overemphasized. Each planning agency should recognize its duty to inform and involve affected citizens of the far-reaching consequences of the 208 plans so that communities can work together to formulate and implement effective plans to solve water quality problems. Without local cooperation and coordination in every step of the areawide planning process, communities could lose their local mandate to the more remote regulatory agencies at the State and Federal level. While it is express policy of EPA to regard planning and problem-solving under section 208 as a local government function, if it appears that this function is not being carried out, EPA must initiate action to meet the goals of the FWPCA. An alternative to this general permit program, with its reliance on planning agencies' BMP recommendations, could be the issuance of individual NPDES permits imposing effluent limitations on the point sources identified in the agricultural activities and separate storm sewer categories. This alternative, as it has often been expressed, is not as environmentally or administratively sound as the general permit concept incorporating BMPs. Thus, planning agencies and their affected constituency are strongly encouraged to work together to develop feasible, workable, environmentally beneficial plans to integrate this general permit program into the local decision-making process.

SUMMARY OF PROPOSED PROGRAM

It is proposed that the general permit program will be implemented in two phases according to the following schedule:

(1) Proposed rules for the general permit program are published today.

(2) *Phase I*—These regulations propose to require permit-issuing agencies to designate general permit program areas (GPPAs).

(a) Criteria upon which to base these GPPAs are listed in this proposed regulation. It is anticipated and strongly recommended that GPPAs be designated according to existing political, institutional and geographical boundaries, particularly section 208 planning areas.

(b) These GPPAs must be designated within six months of the promulgation of the final regulations for general permits.

(3) *Phase II*—Within one year after the GPPAs are designated, it is proposed that general permits will be issued in each GPPA to cover owners and operators of point sources identified pursuant to the March 18, 1976, regulations for separate storm sewers and the July 12, 1976, regulations for agricultural activities.

(a) These general permits will be issued to cover all owners and operators not otherwise receiving individual NPDES permits in the separate storm sewer and agricultural activities categories.

(b) The general permits will be issued following notice and opportunity for hearing.

(c) Procedures will also include opportunity for any owner or operator to exclude himself from the general permit process. Any such excluded owners or operators would then be subject to the conventional NPDES permit program.

(d) General permits will not require applications from individual owners or operators.

(e) General permits will include reasonable conditions determined necessary by the Regional Administrator or Director of a State water pollution control agency to obtain progress in reducing pollution and to meet the goals of the FWPCA.

(4) General permits may be issued for a term of not more than five years, and may be modified, suspended or terminated by the permit-issuing agency under certain conditions. Termination may apply to individual owners or operators to several owners or operators, or to an entire GPPA. In cases where the termination does not affect all owners and operators, the general permit shall remain in effect with respect to those unaffected owners and operators. The two main conditions for termination are as follows:

(a) First, where requirements of an approved, applicable 208 plan are not being met, individual permits may be issued to those owners and operators subject to the plan incorporating the conditions of the plan.

(b) Second, where, even prior to the development of an approved, applicable 208 plan, the EPA Regional Administrator or the Director of a State water pollution control agency finds that a point source in the separate storm sewer or agricultural activities categories is a significant source of pollution, he may require the owner or operator of that point source to apply for and obtain an individual NPDES permit.

It is possible that general permits may be reissued for additional five-year terms where individual permits are infeasible inappropriate or unnecessary.

(5) Following a comment period and consideration of the comments received on this proposed program, final regulations will be promulgated.

It should be noted that the designation of GPPAs for separate storm sewers does not automatically signify designation of such separate storm sewers as significant contributors of pollution pursuant to 40 CFR §§ 124.83(a)(1) or 125.52(a)(1). Designation of separate storm sewers as significant contributors of pollution under §§ 124.83(a)(1) and 125.52(a)(1) is an entirely separate process from the designation of GPPAs.

The following charts indicate the proposed timetables for the issuance of general permits and the relationship of this general permit program to the 208 planning process.

It is necessary to distinguish this program for general permits from that developed by the U.S. Army Corps of Engineers (Corps) to administer a portion of the section 404 permit program for the discharge of dredged or fill material into navigable waters. The Corps' program is limited to "those activities that are substantially similar in nature, that cause only minimal adverse environmental impact when performed separately, and that will have only a minimal adverse cumulative effect on the environment as categories." EPA, however, recognizes that its general permit program will cover numerous, diverse sources of pollution: Public and privately owned storm sewer drains, pipes and outlets discharge sand, gravel, leaves, organic matter, litter, automobile wastes, oil and grease; irrigation return flow ditches, channels and culverts discharge suspended sediments, animal and other organic wastes, pesticides, fertilizer, nutrients, dissolved salts and other dissolved materials.

EPA's program is designed to be local or regional in application in order to address differences in the categories of point sources covered. EPA's program does not impose national numerical limitations on the discharges from separate storm sewers or agricultural point sources. Instead, as much as possible, EPA's program is to be administered at the local level, in coordination with the State and community planning agencies, taking into consideration local variations in climate, topography, rainfall, industrial development, pollutant loads and water uses.

It is believed that EPA's program satisfies the decision in the case of "NRDC v. Train" by issuing permits for all point sources in the designated GPPAs. The general permits issued pursuant to this program will prescribe general conditions to be followed by all persons who own or operate point sources in the separate storm sewer and agricultural activities categories. These general permits also preclude the need for further permitting requirements with respect to individual applications for NPDES permits until such time as 208 plans are implemented or the owner or operator of a point source discharging pollutants is notified that such individual application is required.

Some States administering the NPDES permit program already have workable, effective individual or general permit programs applicable to agricultural point sources. It is not the intent of these regulations to replace or supplant such programs. However, to insure a degree of uniformity of approach, all State programs must conform to basic procedural requirements. The Regional Administrator will review these requirements in State programs upon their submission to him. If the Regional Administrator finds that the State program conforms to the procedural framework and is adequate to progress toward water quality goals he shall approve the program. NPDES States without either an adequate program or any program at all must develop a permit program covering agricultural point sources and separate storm sewers. Within the procedural requirements, each NPDES State is encouraged to develop its own program tailored to the different needs and water quality goals of its area. Where practical, interstate agreements could be arranged for regional areas where there are common water quality problems. Where there are interstate disagreements about water quality goals, the Regional Administrator will aid in developing a program to resolve differences in such goals. Any such resolution may require phased programs, compliance schedules, and close coordination with 208 and other local plans. Each State program, regardless of interstate agreements, must be submitted to the Regional Administrator for review and approval where appropriate. Any NPDES-approved State may develop a general permit program similar to the Federal program. States developing permit programs parallel to that of EPA may enter into agreements with EPA to hold joint public meetings and to issue joint general permits, particularly in areas where similar water problems exist and State and Federal authority overlap. Any State unable to develop a general permit program within the time limits imposed by these regulations should inform EPA of the difficulty.

It should be noted that the evidentiary hearings provided for in these regulations are the same as the adjudicatory hearings referred to in the NPDES regulations. However, the NPDES regulations are currently being revised with respect to the provisions for adjudicatory hearings. This revision includes changing the name for adjudicatory hearings to evidentiary hearings. Evidentiary hearings held under these general permit regulations may only address factual issues relevant to the conditions of the contested general permit(s). All evidentiary hearings held under these general permit regulations shall be conducted in conformance with the revised hearing regulations.

Request for Comments

Interested persons may participate in this rulemaking by submitting written comments to the Legal Branch, Water Enforcement Division (EN-338), Office of Water Enforcement, Environmental Protection Agency, Washington, D.C. 20460. Comments upon all aspects of the proposed regulations are solicited. In particular, comments are desired concerning the definitions in the regulations, the scope of the regulations, the procedural and substantive provisions of the regulations, the administration and function of State programs within the regulations, and the impact and effectiveness of the regulations, including the water quality benefits to be gained as contrasted with the costs to the affected owners and operators. In the event comments object to the approach taken by the Agency in establishing this regulation, EPA solicits suggestions as to what alternative approach should be taken and why and how much such alternative better satisfies the requirements of the court order.

A copy of all public comments will be available for inspection and copying at the EPA Public Information Reference Unit, Room 2922, Rear Library-Mall, Waterside Mall, 401 M Street SW, Washington, D.C. 20460. The EPA Public Information regulations, 40 CFR Part 2, provide that a reasonable fee may be charged for copying. All comments received on or before April 1, 1977, will be considered.

NOTE.—No Inflationary Impact Statement is required by Executive Order 11821 for these proposed regulations since the economic effects will not exceed the criteria established by EPA and approved by the Office of Management and Budget for the preparation of such statements.

(Secs. 304, 402, 501, of the Federal Water Pollution Control Act Amendments of 1972 (87 Stat. 816 et seq., Pub. L. 92-500, 33 U.S.C. 1251 et seq.).)

Dated: January 27, 1977.

JOHN QUARLES,
Acting Administrator.

Part 124 of Title 40 of the Code of Federal Regulations, setting forth State program elements necessary for participation in the National Pollutant Discharge Elimination System, is proposed to be amended as follows:

PART 124—STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION IN THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Subpart I—Special Programs

Subpart I of Part 124 is amended by adding a new § 124.86, "General Permit Program" as follows:

§ 124.86 General permit program.

(a) *Definitions.* For the purpose of this section:

(1) The term "separate storm sewer" is defined in § 124.83.

(2) The term "agricultural point source" is defined in § 124.84.

(3) The term "general permit program area" [hereinafter referred to as GPPT] means any area designated by the Director in which all owners or operators of separate storm sewers or agricultural point sources, or both, are subject to the same general permit, other than owners and operators to whom individual NPDES permits have been or will be issued.

(4) The term "general permit" means an authorization to discharge published according to official State procedures and applicable to all owners and operators of separate storm sewers or agricultural point sources, or both in a designated GPPA, other than owners and operators to whom individual NPDES permits have been or will be issued.

(5) The term "owner or operator" means any person who owns or operates any separate storm sewer or any agricultural point source.

APPENDIX B

STUDY METHODOLOGY AND FINDINGS

APPENDIX B
STUDY METHODOLOGY AND FINDINGS

Three principal types of research and analysis were done in San Mateo County to identify surface runoff-related problems. These included surveying agencies in the County to identify possible sources and locations of runoff-related problems, stormwater sampling, and computer modeling of 12 County watersheds using the ABAG MAC computer program. The results of these efforts are indicated in the following pages. A more detailed discussion of these efforts can be found in two previous progress reports submitted to city and ABAG staffs.* These reports are available on request.

In general, the study efforts were useful in indicating general areas of possible concern. In terms of a basis for planning, the survey results have been the most useful effort. Sampling and modeling indicate that surface runoff can carry high concentrations of possible pollutants. Yet, the effects of these on local or regional waters are not clearly understood. More detailed survey or sampling work focused on particular problem areas or potential pollution sources is recommended in the Plan as a more productive effort for the future.

1. Stormwater Sampling.

A stormwater sampling program was initiated in March, 1977 to obtain information for estimating pollutant loads from San Mateo County watersheds. The late start to this sampling program and the present drought limited the amount of data collected in this County. Sampling locations were selected to provide as realistic a picture as possible of surface runoff pollutants generated by different land uses.

Only one storm was sampled for each of these sites. However, ten samples were taken for each storm at each site and were analyzed for 12 different water quality indicators. Very little historic stormwater sampling has been done either in this County or elsewhere, to serve as a comparision for this year's results. Nonetheless, results from San Mateo County compared very favorably with those from other stormwater sampling conducted both in the Bay Area and nationwide.

For purposes of this Runoff Study some of the results of Bay Area sampling were pooled to develop a common data base which could be used for comparable modeling and analysis efforts. These "pollutant" concentrations for specific land uses are indicated on Table B-1.

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* Examination of Existing Water Quality Problems in San Mateo County, Progress Report No. 9 to ABAG, San Mateo County Planning Division and PBQ&D, Inc., April 19, 1977.

Examination of Future Water Quality Problems in San Mateo County, Progress Report No. 13 to ABAG, San Mateo County Planning Division and PBQ&D, Inc., June 7, 1977.

TABLE B-1

DATA BASE FOR USE IN MAC MODEL:
A COMPOSITE OF BAY AREA SAMPLING RESULTS

	Pollutant Concentration, Mg 1					
Land Use	BOD	SS	VSS	N	P	Pb(3)
Residential	15.0	(1)	25%	3.5	0.4	0.20
Commercial	20.0	150	70	5.0	0.7	0.40
Industrial	13.0	120	50	3.0	0.5	0.70
Open	4.0	(2)	15%	2.0	0.3	0.02

(1) The range of suspended solids concentrations for residential land use varied from 200 mg/l to 800 mg/l. A value of 200 mg/l was adopted for use in San Mateo County because the percentage of land use with construction activity is low and most of the streams on the bayside are channelized.

(2) A value of 175 mg/l was adopted for San Mateo County because the trend exhibited by the sampling data for open land SS concentration was found to be between Residential and Commercial concentrations.

(3) These values were developed by PBQ&D, Technical Consultants, based on local sampling results.

2. Modeling.

Two computer models were potentially available to the Counties to help bridge the gap of limited sampling data and to generate simulated amounts of possible pollutants from each County. Only one of these models, the MAC model, has been used throughout the Bay Area. The SWMM model, which provides a more detailed simulation of rainfall - runoff - pollution relationships for a single watershed was not calibrated early enough for use by San Mateo County in drafting the Initial Plan. It may prove useful, however, in the Continuing Planning Process.

The MAC model generated total annual pollutant loads for twelve large watershed units in San Mateo County. The locations of the watersheds and the pollutant loads which were simulated for these watersheds are shown on Figure B-1 and Table B-2.

Figure B-1
San Mateo County MAC Model Watersheds

Table B-2

San Mateo County MAC Model Results*

(ANNUAL POLLUTANT LOADS (1000's#)

Year	MAC Watersheds / Parameters	PACIFICA	BRISBANE	SOUTH SAN FRANCISCO	MILLBRAE-BURLINGAME	SAN MATEO CREEK "A"	SAN MATEO CREEK "C"	BELMONT-ATHERTON	SAN FRANCISQUITO "A"	SAN FRANCISQUITO "C"	PESCADERO CREEK	HALF MOON BAY "A"	HALF MOON BAY "B"
	Acres (000)	12.8	4.4	11.1	10.6	22.4	7.5	30.7	22.3	7.1	113.0	37.6	3.3
1975	BOD	217	71	273	355	145	155	580	257	99	485	212	19
1975	SS	3731	1097	3576	4223	5034	2219	8129	4900	1326	20,984	8275	534
1975	VSS	1523	474	1432	1424	3207	814	2993	2252	603	14,407	5449	283
1975	TOTAL N	45	15	61	83	15	35	130	51	22	27	23	5
1975	TOTAL P	7	3	10	11	9	5	19	10	4	36	15	1
1975	LEAD	3	2	7	9	1	2	10	3	2	3	2	0
1975	WATERSHED TOTALS	5526	1662	5359	6105	8411	3230	11,861	7473	2056	35,942	13,976	842
1985	BOD	335	93	321	340	185	174	563	374	141	485	234	25
1985	SS	4949	1338	4116	4109	5379	2352	7955	5760	1608	20,914	8893	759
1985	VSS	1609	499	1539	1461	3182	770	3033	2023	544	14,377	5415	275
1985	TOTAL N	75	21	73	78	26	40	125	82	33	28	42	12
1985	TOTAL P	10	3	11	11	10	5	19	12	4	36	16	2
1985	LEAD	5	2	8	8	2	3	10	5	3	3	3	1
1985	WATERSHED TOTALS	6983	1956	6068	6007	8784	3344	11,705	8256	2333	35,843	14,603	1074
2000	BOD	391	100	346	347	203	178	613	374	148	485	283	22
2000	SS	5516	1410	4286	4159	5539	2371	8289	5760	1778	20,769	10,315	831
2000	VSS	1662	505	1580	1466	3174	779	3114	2023	644	14,312	5339	245
2000	TOTAL N	89	22	79	80	30	41	138	82	34	30	85	13
2000	TOTAL P	11	3	12	11	10	5	20	12	5	36	20	2
2000	LEAD	5	2	9	9	2	3	12	5	3	3	6	1
2000	WATERSHED TOTALS	7674	2042	6312	6072	8958	3377	12,186	8256	2612	35,635	16,048	1114

The pollutant loads by themselves are not very useful for determining the severity of any particular constituent. Three basic techniques were used for analysis. Each of these techniques, however, was limited by lack of widely accepted evaluation criteria.

o Comparision to water quality criteria. At present there are no water quality standards for surface runoff. Despite this it seemed useful to determine whether there are concentration levels of pollutants which may be considered safe and levels which are increasingly problematical. For purposes of this study, those criteria used by San Mateo County are indicated on Table B-2. The rationale for these levels was developed by technical consultants, PBQ&D, Inc., and is included in detail in Examination of Future Water Quality Problems in San Mateo County, June 7, 1977.

  The gross pollutant loads from each MAC watershed were translated to concentration levels for 1975, 1985 and 2000, these are indicated on Table B-4 . Future projections were based on ABAG Series III population and land use projections which were reviewed and modified by County staff.

  The basic conclusions from this evaluative technique are indicated below.

Level of Problem	Parameter(s)
No Problem	Total nitrogen, Total Phosphorus, and BOD
Acceptable Level (of pollution)	-0-
Marginally Acceptable Level (of pollution)	Suspended and Volatile Suspended Solids. An area for concern primarily in the coastal area.
Unacceptable Level (of pollution)	Lead - Probably a problem throughout the County, but especially in the urban Bayside.

TABLE B-3
Levels of Pollutant - Concentrations
Used in San Mateo County Analysis

Levels	No Problem	Acceptable Level of Pollution	Marginally Acceptable Level of Pollution	Unacceptable Level of Pollution
BIOLOGICAL OXYGEN DEMAND (BOD_5)	15 mg/l Maximum daily concentration	22.5 mg/l	30 mg/l	30 mg/l
SUSPENDED SOLIDS (SS)	25 mg/l	26 mg/l 79 mg/l	80-400 mg/l	400 mg/l
VOLATILE SUSPENDED SOLIDS	Specific levels are dependent on site-specific evaluation. However for the purposes of this evaluation, VSS Levels are assumed similar to those for suspended solids.			
TOTAL NITROGEN (TOTAL N)	Since the San Francisco Bay is not nutrient limited, there are no assigned levels of pollutant-concentrations.			
TOTAL PHOSPHORUS (TOTAL P)				
LEAD	No measured amount of lead	0.03 mg/l		0.03 mg/l

Table B-4 Pollutant Concentration Levels in Model Watersheds for 1975, 1985, 2000

PARAMETERS / WATERSHEDS (With Acres)	YEAR	BOD 1975	BOD 1985	BOD 2000	SS 1975	SS 1985	SS 2000	VSS 1975	VSS 1985	VSS 2000	TOT N 1975	TOT N 1985	TOT N 2000	TOT P 1975	TOT P 1985	TOT P 2000	LEAD 1975	LEAD 1985	LEAD 2000
		CONCENTRATIONS (mg/L)																	
PACIFICA	12,792 Ac.	11	13	14	188	194	195	77	63	59	2.0	3.0	3.1	0.4	0.4	0.4	0.15	0.20	0.20
BRISBANE	4,431 Ac.	11	12	13	171	177	178	74	66	64	2.0	3.0	3.0	0.5	0.4	0.4	0.31	0.26	0.25
SOUTH SAN FRANCISCO	11,076 Ac.	13	13	14	165	169	167	66	63	62	3.0	3.0	3.0	0.5	0.4	0.5	0.32	0.30	0.35
MILLBRAE-BURLINGAME	10,564 Ac.	14	14	14	171	169	169	58	60	59	3.0	3.2	3.0	0.5	0.4	0.45	0.36	0.33	0.37
SAN MATEO CREEK "A"	22,419 Ac.	5	6	7	177	180	181	113	106	103	0.5	0.9	1.0	0.3	0.3	0.3	0.04	0.07	0.07
SAN MATEO CREEK "C"	7,537 Ac.	13	14	14	186	189	188	68	62	62	3.0	3.0	3.0	0.4	0.4	0.4	0.17	0.20	0.24
BELMONT-ATHERTON	30,742 Ac.	13	13	13	182	180	178	67	69	67	2.9	2.8	3.0	0.4	0.4	0.4	0.22	0.20	0.26
SAN FRANCISQUITO "A"	22,320 Ac.	10	13	13	185	192	192	85	67	67	1.9	3.0	3.0	0.4	0.4	0.4	0.11	0.20	0.17
SAN FRANCISQUITO "C"	7,091 Ac.	13	15	14	168	174	173	76	59	63	2.8	4.0	3.0	0.5	0.4	0.5	0.25	0.30	0.30
PESCADERO CREEK	112,950 Ac.	4	4	4	174	174	173	120	119	119	0.2	0.2	0.3	0.3	0.3	0.3	0.03	0.02	0.03
HALF MOON BAY "A"	37,637 Ac.	4	5	5	175	177	182	115	108	94	0.5	0.8	1.6	0.3	0.3	0.35	0.04	0.06	0.10
HALF MOON BAY "B"	3,192 Ac.	6	6	5	178	188	195	94	68	57	1.7	3.0	3.0	0.3	0.5	0.5	0.00	0.20	0.20

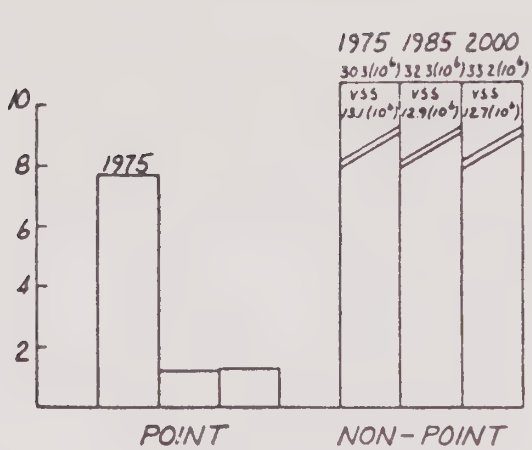
o Comparison of point and non-point pollution sources. This technique provided a general idea of how severe surface runoff may be by comparing it with loadings from municipal and industrial discharges for four indicators: Suspended solids, phosphorus, nitrogen, and BOD. The comparisons were based on six month discharges of storm runoff during the rainy season, (November-April). The results of this effort shown on Tables , indicate that suspended solid loads were significantly greater in surface runoff, and that BOD loadings may be greater in surface runoff than in treatment plant effluent, particularly in future years.

The suspended solids loading is a less significant comparision as siltation would not become a part of sewage. BOD levels are probably not a problem in the Bay as a whole, but could be of concern in Bay extremities, and more local or isolated water bodies.

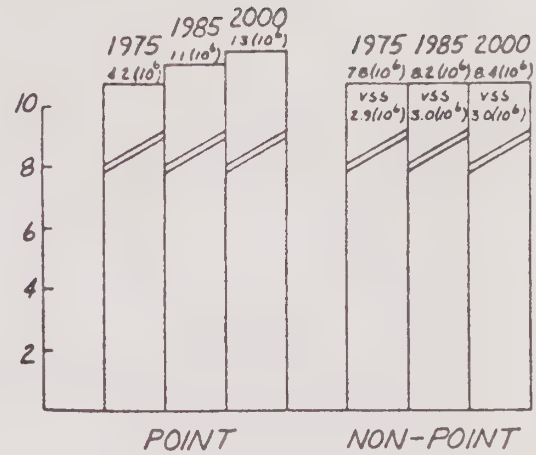
To compare the point and non-point discharges it was necessary to identify areas where the boundaries of the MAC watersheds and sewage service areas were roughly comparable, where they discharged into the same general location, and where information was readily available. For this purpose the twelve (12) MAC watersheds and twelve (12) sewerage units were grouped into five (5) areas which met these criteria as closely as possible. The combinations are indicated in Figure B-2. The five areas include four Bayside groupings (although one had to be eliminated) and one Coastside grouping. In addition, one overall comparison was made for the entire Bayside. See Tables B-5,6,7 and 8 for results.

Figure B-2 MAC Watershed - Sewerage Unit Combinations for Point-Nonpoint Analysis

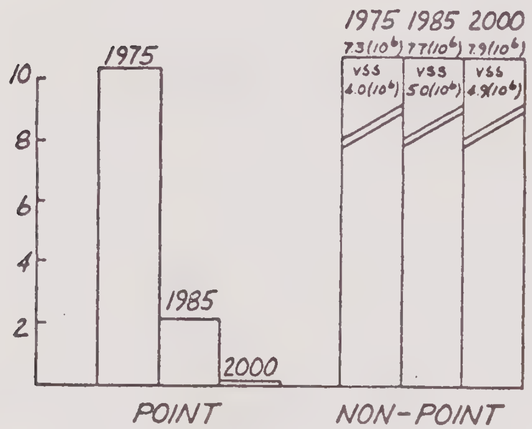
Table B-5
Point and Nonpoint Comparisons



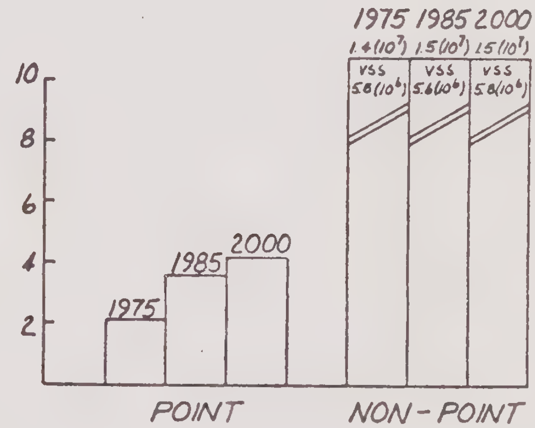
COMBINATION BAYSIDE



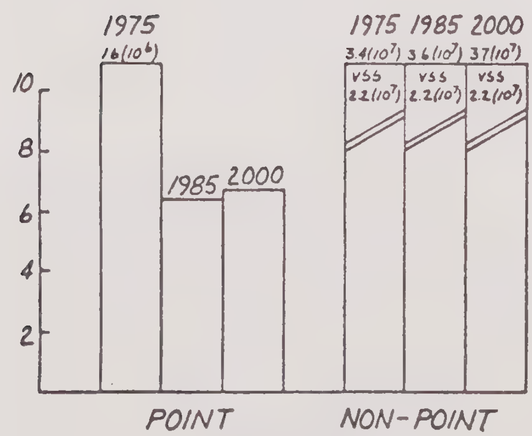
COMBINATION 2



COMBINATION 3



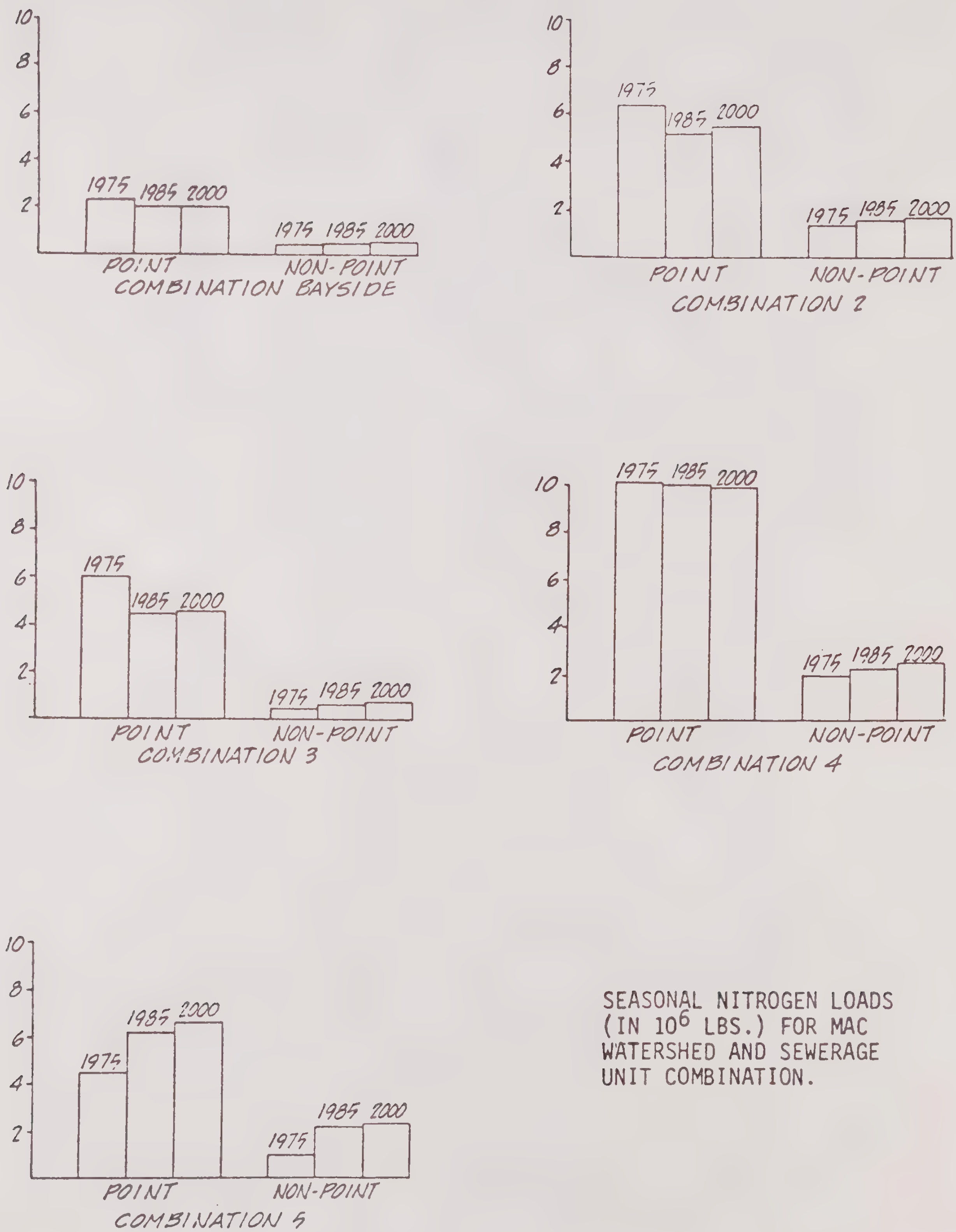
COMBINATION 4



COMBINATION 5

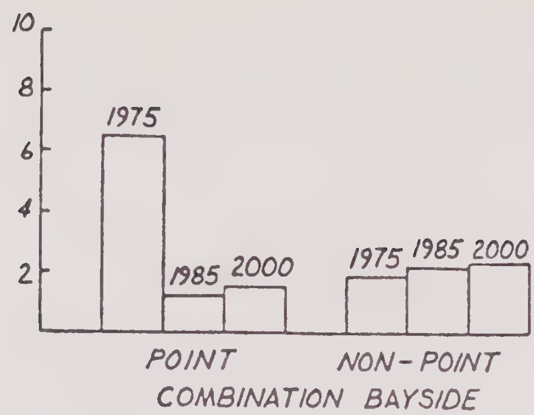
SEASONAL TSS AND VSS LOAD
(IN 10^5 LBS.) FOR MAC
WATERSHED AND SEWERAGE
UNIT COMBINATIONS

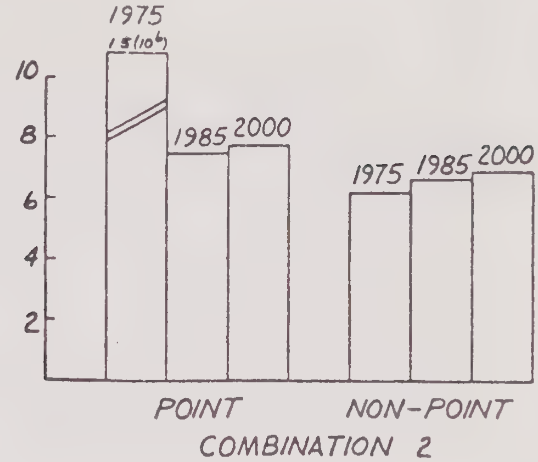
Table B-6
Point and Nonpoint Comparisons

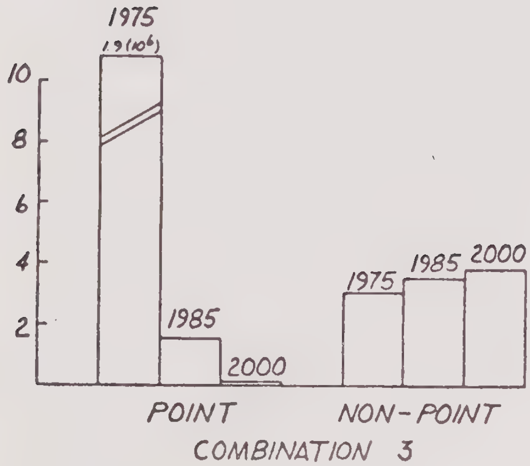


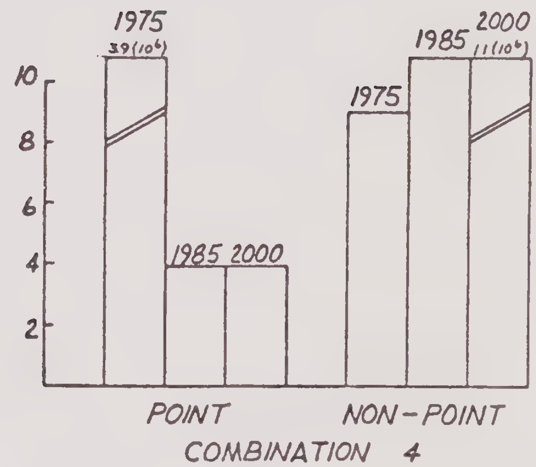
SEASONAL NITROGEN LOADS (IN 10^6 LBS.) FOR MAC WATERSHED AND SEWERAGE UNIT COMBINATION.

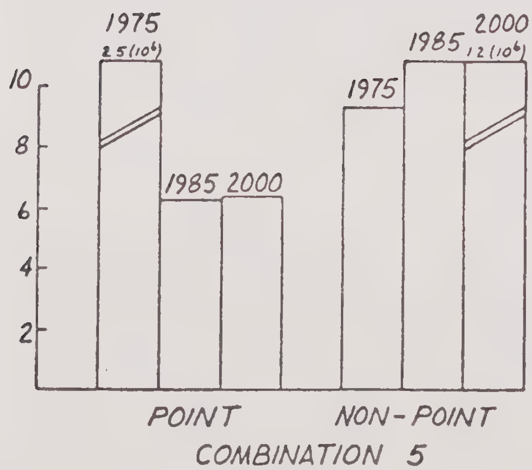
Table B-7
Point and Nonpoint Comparisons





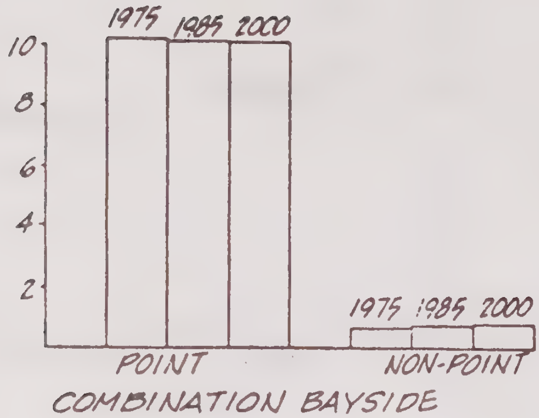


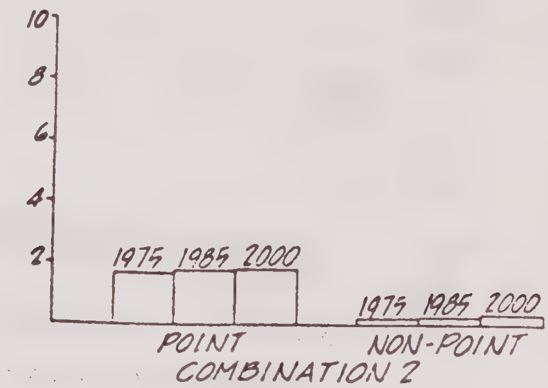


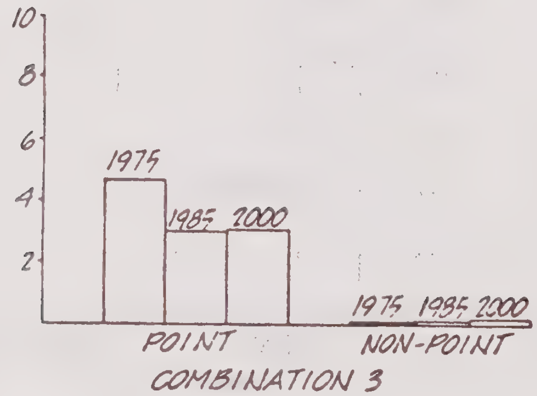


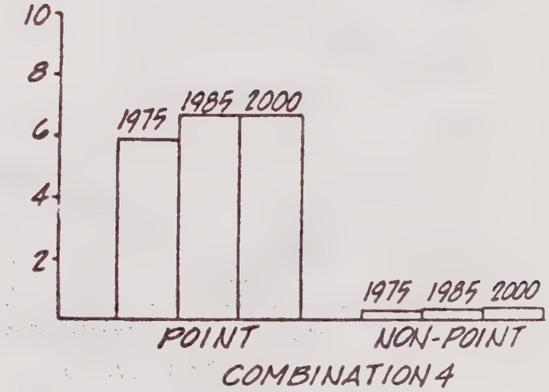
SEASONAL BOD LOAD (IN 10^5 LBS.)
FOR MAC WATERSHED AND SEWERAGE
UNIT COMBINATION.

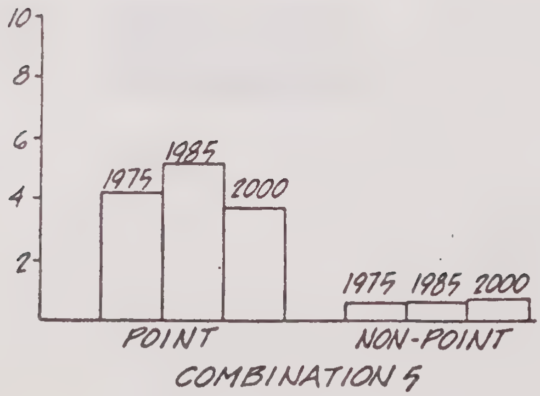
Table B-8
Point and Nonpoint Comparisons











PHOSPHORUS LOADS (IN 10^5 LBS.)
FOR MAC WATERSHED AND SEWERAGE
UNIT COMBINATION.

o Regional comparisions and evaluation of MAC data. The two techniques described above have been useful in indicating possible areas of concern for planning purposes. The precise cause and effect of the simulated pollutant loads, however, is not known.

The percent contributions of simulated pollutant loads to San Francisco Bay from all counties are indicated on Table B-9 . Results of the comparison of point and nonpoint loads are indicated on Table B-10. Again, it is not understood how these pollutant loads affect the environment once they enter major water bodies such as the Bay and Ocean where they can be diluted or dispersed by currents.

The Bay Model developed for ABAG is one attempt to understand these relationships. The model results have been depicted on three-dimensional graphs. Results for BOD, nitrogen, phosphorus dissolved oxgen are available in two ABAG Technical Memoranda (No. 21 and No. 23). No regional conclusions have been made yet about this effort.

TABLE B-9 *

County Percent Contributions to Total Surface Runoff Pollutant Loads to San Francisco Bay (1975)

COUNTY	BOD	TN	TP
Alameda	14%	14%	11%
Contra Costa	11%	11%	10%
Marin	10%	11%	10%
Napa	11%	16%	17%
San Francisco	20%	8%	16%
San Mateo	8%	6%	8%
Santa Clara	13%	16%	13%
Solano	6%	8%	7%
Sonoma	7%	10%	8%

From these figures it is evident that the greatest BOD loads to the Bay and ocean are produced by San Francisco, Marin and Alameda counties. San Mateo, Santa Clara, Napa and Contra Costa counties produce smaller loads, followed by Sonoma and Solano counties. These last two counties produce the smallest loads largely because only a small portion of their areas drain to the Bay.

*Taken from Surface Runoff Brief #2, June, 1977 (ABAG)

TABLE B-10
Regional Summary of MAC Modeling Results
Pollution Loads From Surface Runoff
Compare with Point Source Loads*

- Suspended solids loads from surface runoff are considerably higher than treated point source loads in all counties. In fact, loads from surface runoff also exceed untreated point source loads. Surface runoff produces more than 20 times as much suspended solids as do point sources after treatment. This ration is expected to remain about the same through the year 2000.

- Surface runoff contributes substantially more heavy metals to the Bay than point sources. Calculations of equivalent heavy metals (see footnote, figure 5) from both sources show that surface runoff produces more than four times as much heavy metals.

- On a regional basis, BOD from surface runoff now accounts for about 25% of the total BOD load to the receiving waters. This figure is expected to rise to 60% in 1985 as treatment efficiencies improve and remain at that level through the year 2000 (see figure 5). Thus, during the 6 month rainy season, about 1 1/2 times more BOD will come from surface runoff than from point sources.

- In the rural counties (Marin, Napa, Solano and Sonoma), more BOD is produced by surface runoff than by point sources. In the urban counties (Alameda, Contra Costa, San Mateo and Santa Clara) the BOD loads from point sources are substantially greater than from nonpoint sources in 1975. By 1985, loads from the two sources will be nearly equal. This relationship is projected to hold through the year 2000 (See Figure 6).

- The percentage of the total nutrient load (nitrogen and phosphorus) produced by surface runoff is much smaller than for suspended solids and BOD. In a regional basis (in 1975), surface runoff contributed only 1% of the total phosphorus load and 9% of the total nitrogen load. These figures are projected to increase to 7% and 28% respectively in the year 2000 as nutrients removal efficiencies in treatment plants are improved. In three of the four rural counties, however, more nitrogen is and will be produced by surface runoff than by point sources (see Figures 5 and 6).

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* From Surface Runoff Brief #2, Pollution Problems, ABAG, June 22, 1977.

3. San Mateo County staff surveyed all city and district officials as well as many State, regional and federal agencies to determine potential sources of surface runoff pollution, and water quality problems associated with runoff. Information on mitigation practices was also obtained and is discussed in the Plan. This information has served as the backbone of this Runoff Plan. The survey indicated the following:

- Potential Problem Sources in the Stormwater System

  - Debris in streams, channels and storm inlets is identified by almost every local agency as a continual problem that affects flood control, mosquito abatement, rat control, and probably, runoff quality. This debris enters these areas from direct dumping, littering, and street or other surface accumulations.

  - Significant infiltration of stormwater into sanitary sewer lines occurs during storm events throughout the County. This, in turn, has led to sanitary sewer line malfunctions and accidental spills of raw sewage.

- Potential Problem Sources on the Land

  - Street and parking lot debris was not identified as a major problem, possibly because there are already considerable investments in street sweeping in most communities.

  - Erosion associated with construction is considered to be a relatively minor problem partly because much of the city land on the Bayside is already developed. However, erodable soils are present on developable Bayside hills and Coastal areas, and siltation in streams and channels was noted by many local agencies.

  - Some potential problem sources are notable only in isolated areas. In particular, excessive fertilizer and pesticide use, and large concentrations of animals do not occur on a Countywide basis.

- Water Quality Problems which may be Runoff-Related. This listing of problems is notable for the absence of several potential problems. According to the San Francisco Water Department, Crystal Springs Reservoir, which supplies water to San Francisco and much of the Peninsula, does not have water quality problems attributable to surface runoff. The reservoir's water quality will be protected by continued public ownership and non-development of the entire watershed.

The San Francisco Water Department has also stated that the beneficial use of Lake Merced in San Francisco is not believed to be affected by runoff originating in San Mateo County.

Bathing waters in the County are all considered safe for swimming by the County Environmental Health Office.

This relatively bright picture for water quality in San Mateo County should serve as a backdrop for the summary of problem areas provided below.

It should be noted that only those municipal or industrial dischargers which have had recent problems noted in water samples taken near their point of discharge* are indicated on Figure . Several dischargers have noted recent problems in their effluent samples, but resulting identifiable problems have not been noted in the receiving waters. Most dischargers are undergoing significant plant improvements which should minimize future problems.

- Bayside

  Water quality problems on the Bayside of San Mateo County are restricted almost entirely to lagoons which are tributary to the Bay (see points B.1, B.3, B.6 and B.7 on Figure 1). Problems here are caused by poor circulation, surface runoff, and direct discharges of contaminants. The impact of lagoon problems on the Bay itself, however, is not clear. The primary beneficial uses hindered in most of the lagoons appear to be the recreational activities for which they were constructed, aesthetics, and, in some cases, fishing.

  Prospects for one problem area, the Foster City Lagoon system, are relatively bright. Major capital improvements and management planning are underway to help assure that this lagoon will meet its permit requirements and provide optimum recreation for area residents.

  Four shellfish (Clam) beds are regularly tested by the County Environmental Health Office. Harvesting areas are posted as potentially hazardous for human consumption. The shellfish beds in the vicinity of Coyote Point, in Burlingame and San Mateo, may be affected by surface runoff from nearby

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* This information was received from the Regional Water Quality Control Board which reviewed its records for discharges which have been primary problem areas in the past. They did not review all permitted discharges.

drains. Beds in the vicinity of the San Mateo Bridge are probably affected to the greatest extent by nearby sewage discharges. Major planned improvements to the San Mateo and Foster City sewage systems are being constructed for protection of shellfish. Other shellfish beds identified in Regional Water Quality Control Board reports have not been verified by field observations. The County Health Department monitors all known shellfish beds.

An additional problem area was identified in an ABAG special studies report in the vicinity of Redwood Creek where high silver concentrations were noted. These concentrations are believed to be derived from nearby treatment plant effluent.

- Coastside

Coastside water problems occur primarily near the mouths of several creeks; they have not been noted in the higher reaches of the streams. Four areas have some problems which may be associated with surface runoff (Points C.1, C.2, and C.4. on Figure B-3) and beneficial use degradation. Trout and other fish have been adversely affected by water quality in San Pedro Creek (Point C.1.), and may be affected in Frenchman's Creek (Point C.3.). Shellfish beds at points C.1, C.2., C.4., and C.5. are all adjacent to the mouths of creeks and may be impacted by runoff. Shellfish beds along the Coastside are posted as "potentially hazardous." It should be noted that many of the creeks' problems, such as stagnant pools and algae blooms, are associated with the reduced flows of summertime and not the winter runoff period.

Several municipal discharges are not consistently meeting effluent quality standards along the Coast. However, no problems have been identified in receiving water samples, and proposed improvements to these sewerage systems should correct existing problems.


SAN MATEO COUNTY
CALIFORNIA
B.1.
B.2.
B.10.
B.3.
B.4.
B.5.
B.6.
B.7.
B.8.
B.9.
C.1.
C.2.
C.3.
C.4.
C.5.
C.6.
PACIFIC
OCEAN
FIGURE B-3 KNOWN WATER QUALITY PROBLEMS IN SAN MATEO COUNTY
• PROBLEM AREA
◆ SHELLFISH BEDS
○ POSSIBLE SURFACE RUNOFF IMPACTS

Key to Figure 1

Bayside Water Quality Problems

B.1. Brisbane Lagoon: Algae, weeds, siltation, stagnant water, and oil or grease noted in the survey of local public officials.

B.2. Airport: Some oil in nearby waters noted in public participation process.

B.3. San Mateo Wastewater Outfall: Total coliform organisms noted in the receiving waters as reported to the Regional Water Quality Control Board (April 1977). Major plant improvements presently being completed to correct problems. County Health Department bacteriological samples in the vicinity of the outfall are regularly very low (approximately 45 MPN/1--ml).

B.4. Marina Lagoon: Algae, stagnant water, odor, bacteria, and fish problems noted in local survey of public officials.

B.5. Foster City Lagoon System: Algae blooms, weeds, stagnant water, grease, oil, bacteria, and fish problems noted in the survey of local public officials. A Lagoon System Managment Plan is presently being updated, and major capital improvements are underway to help meet NPDES permit requirements and improve beneficial uses of this system.

B.6. Marine World: Fish kill in receiving waters noted by California Fish and Game in the past year, due to improper pesticide usage. Some problems with pH noted in receiving waters in reports to the Regional Water Quality Control Board. Discharge from the area, presently controlled by an NPDES permit, becomes part of the intake water for Marina Lagoon.

B.7. Redwood Shores Lagoon System: Some problems with stagnant water and algae bloom noted in local survey.

B.8. Shoreway Road Area: Oil, grease, and other contaminants noted in reports to the Regional Water Quality Control Board (1977) in the flood control zones near Shoreway Road.

B.9. San Francisquito Creek: Occasional problems in the past with trout or stickleback kills (noted by the County Health Department and California Fish and Game), attributed primarily to reduced flows in summer.

B.10. Coyote Point Shellfish Beds. Small beds which are situated near drains and may either be beneficial or adversely impacted by storm drainage.

Coastside Water Quality Problems

C.1. San Pedro Creek: California Fish and Game cites area as highest priority problem in San Mateo County, noting an annual fish kill of juvenile steelhead trout and resident fish (sculpen, stickleback). Problem attributed by Fish and Game to urban drainage and dumping (from shopping center), aggravated in the summer and throughout the present drought by low flows. Other problems noted in the local survey include siltation, stagnant water, bacteria, and sewer system problems. Nearby shellfish beds may be affected.

C.2. Pillar Point Harbor Beach: Some siltation and oil noted in local survey may affect nearby shellfish beds.

C.3. Frenchman's Creek: Some siltation and algae noted in local survey. California Fish and Game notes area as second highest priority for San Mateo County. There are no records as yet of fish kills, but drainage from a major horse stable flows directly into the creek with possible adverse effects.

C.4. Martin's Beach: Some algae problems noted in local survey. Runoff from Lobitos Creek may affect nearby shellfish beds.

C.5. Pescadero Marsh: Some stagnant water problems noted by Fish and Game, attributed primarily to low flows and water diversion rather than surface runoff.

C.6. Pescadero Groundwater: Bacteria and high nitrate levels found in local groundwater and attributable primarily to septic tanks.

APPENDIX C
SCREENING OF CONTROL MEASURES

Appendix C

Screening of Control Measures

Included in this appendix are control measure ideas provided by the Association of Bay Area Governments (ABAG), local jurisdictions, and the San Mateo County Regional Planning Committee. A control measure screening process, described in Section II. B. of the Plan was used to determine recommendations for this Initial Plan. Tables which document this screening process are included here.

ABAG LIST OF CANDIDATE CONTROL MEASURES

MEASURES TO REDUCE ACCUMULATION OF POLLUTANTS PRIOR TO RUNOFF

A-1 Implement street flushing

A-2 Improve street sweeping

A-3 Repair streets

A-4 Control the use of certain chemicals

A-5 Control the use of lots

A-6 Control littering and solid waste practices

A-7 Control contaminants from domestic animals

A-8 Control the use of motor vehicles

A-9 Control the direct discharge of pollutants into storm sewers

A-10 Eliminate cross-connections with sanitary sewers

A-12 Clean catchbasins

A-13 Clean storm sewers and drainage channels

MEASURES TO REDUCE AMOUNT OF POLLUTANTS AND THE PEAK FLOW OR VOLUME OF RUNOFF

B-1 Prevent roof drainage from entering storm sewers directly

B-2 Detain precipitation on rooftops

B-3 Direct runoff away from areas which contain contaminants

B-4 Retain runoff from areas which contain contaminants

B-5 Impound runoff in upstream channels

B-8 Regrade disturbed areas

B-10 Stabilize stream channels and banks

B-12 Enhance surface retention and infiltration to minimize alteration of natural rainfall/runoff relationships

B-15 Control erosion at construction sites

MEASURES TO TREAT AND STORE RUNOFF

C-1 Treatment and storage of runoff

The following is a list of those control measures which were suggested for potential implementation in the local survey of jurisdictions in San Mateo County.

1. Controls for problems in the Stormwater System (channels, lagoons, catch basin).

- Purchase or sharing of vacuums for catch basin cleaning.
- Purchase or sharing of algae harvesters or skimmers for lagoons.
- Purchase or sharing of cable-bucket systems for storm sewer line cleaning.
- Improving dumping controls or mitigation of dumping through education, etc. (See Solid Waste controls, below).
- Increased frequency of catch basin and channel cleaning.
- Lagoon system management improvements.
- Installing grates or bars at storm inlets, catch basins.
- Replacing poorly functioning storm inlets or catch basins or "bubble-ups" (through federal grants?)
- Installing energy dissipators for storm water to reduce erosion.
- Continuing or initiating drainage master planning efforts.
- Redesign of collection and disposal of drainage near dense animal concentrations (ie. stables).

2. Controls or Improvements to the Solid Waste System.

- Educational programs on litter, dumping, oil recycling, household hazardous waste disposal, fertilizer and pesticide use.
- Improving or providing garden and general debris collection.
- Improving or providing for oil recycling and household hazardous waste disposal.
- Litter or dumping ordinances improved or enforced.
- Increased animal waste cleanup or abatement programs.

3. Controls or Improvements to Programs for Street Surface Contaminants.

- Implement parking restrictions to increase sweeping efficiency.
- Improve scheduling and public notification to encourage off-street parking when sweeping.

- Improve interagency agreements on sweeping (ie. Caltrans service or reimbursement for El Camino maintenance--see Redwood City).
- Increase curbing and guttering of streets where street sweeping would be desirable.
- Utilize porous pavements or minimize the amounts of pavement.

4. Controls for Construction or Rural area Erosion.

- Utilize Resource Conservation District Services for on-site recommendations regarding optimum hydroseeding mixtures. etc.
- Implement a grazing ordinance.
- Improve tillage practices through education.
- Encourage replacement of annual grasses with perrenials.
- Install silting basins, debris basins, small dams.

4. Controls or Improvements to Sewer System (measures which would minimize sewer failures and contamination of stormwaters).

- Expanded testing programs using T.V., smoke-testing, infiltration/inflow analyses.
- Improved or expanded sewer line maintenance, including repairing/replacing old lines, initiating slip-lining, disconnecting known illegal connections.
- Sewer line modifications, including: raising manholes, installing stormproof covers on manholes.
- Sizing plants and pumps to accept infiltrated water.

The following is a list of ideas generated at a Regional Planning Committee public meeting held April 28, 1977.

1. Controls for accumulation of "pollutants."

- Compost grass clippings and other garden waste.
- Recycle used oil.
- Minimize use of chemical fertilizers.
- Dispose household wastes in dry wells.
- Establish neighborhood composting centers.
- Support oil recycling centers.
- Establish recycling service for household hazardous wastes.
- Provide education on dumping composting; oil recycling; auto repair.
- Encourage neighborhood cleanup days; weeks.
- Encourage individual and group activities through: education, coordinating citizen efforts sponsoring clean-up and maintenance.
- Establish centers for recycling wastes.
- Providing free dump days or special pick-ups.
- Enforcement of existing ordinances.
- Cooperation with "ROAR" to recycle oil.
- Focus channel cleaning at points of natural or predictable deposition. Use present road crews for pick-up.
- Curbside notices near storm inlets.
- Screen storm inlets.
- Change timing of sweeping.
- Improve access to dumps.
- School programs for education efforts.
- Bottle bill.
- Assist with education effort.
- Regional Transportation System.
- Maintain auto pollution standards.
- Encourage electric vehicles.
- Federal subsidies.

2. Amount and speed of runoff from roofs; lawns; streets; stormwater system; construction sites (Includes ways to hold water; increase its absorption into the soil; make it available for reuse).

- Utilize drip irrigation.
- Increase porosity of soil.
- Use "rain barrels" under gutters.
- Encourage porous parking lots.

- o Encourage old-fashioned strip driveways.
- o Building more golf courses near Bay.
- o Construct more ponding areas; lagoons and use water for parks.
- o Encourage landscaping in paved or bare areas.
- o Establish ordinances permitting access to private property to enforce anti-dumping regulations.
- o Use composted mulch for city lands; citizens.
- o Consolidate growth or reduce impervious cover.
- o Promote natural creekbeds.
- o Open some Bayfront dikes.
- o Create new reservoirs whereever possible.

3. Other

- o Stop development near the Bay

TABLE C-1. Screening Control Measures for Problem Priorities

Potential Problem	Possible Causes or Locations of "Problems"	Control Measure Options	Discussion of Criteria for Selection	Recommendations for Initial Plan
A. Accumulations of Debris and Vehicle Waste	General debris; garden waste; used oil; animal waste; auto emissions, leaks and wear.	ABAG List: A. Measures to reduce accumulation of pollutants prior to runoff: (See Appendix for further description) A-1. Street Flushing A-2. Street Sweeping A-3. Repair Streets A-4. Control chemical use A-5. Control use of lots A-6. Control littering/solid waste practices A-7. Control animal contaminants A-8. Control vehicle use A-9. Control direct discharges A-12 Clean catchbasins A-13 Clean storm sewers and drainage channels C. Measures to treat and store runoff C-1. Treatment and storage of runoff Other: -Vehicle design and erosion controls -Education for prevention.	Criteria #1: Existing Practices Each of the measures, except street flushing, is practiced in this county to some extent. Criteria #2: Existing Interest The County 208 Steering Committee, at its July 7 meeting, informally approved closer analysis of A-2, A-6, A-7, A-9, A-12, and A-13. During the course of this study, extensive interest has been shown in education to prevent littering, dumping and direct discharges of pollutants. Criteria #3: Multiple Benefits All of the practices could have multiple benefits to a community. Education designed to prevent accumulations of pollutants and to encourage alternative practices by citizens could eventually reduce the burden on many clean-up services. Likewise, improved vehicle design could reduce the amount of pollutants, make maintenance easier, and reduce the local burden of clean-up. Criteria #4: Widespread Application Those measures which appear to be most applicable throughout the County are A-2, A-6, A-9, A-12, A-13, vehicle design, and education. Many of the other controls are probably more applicable in smaller areas, i.e. areas with specific water quality problems where all possible sources should be investigated; and areas with special conditions such as high animal concentrations, poor street repair, and high chemical use. Generally, runoff storage and treatment possibilities would be very limited both in terms of possible locations and in cost. Street flushing technology must be demonstrated in a municipal setting before it can be considered for application.	1) Determine more clearly the sources, extent and severity of potential problems. 2) Recommend a program to encourage vehicle construction and maintenance standards designed to protect water resources. 3) Develop a coordinated prevention program to reduce pollutant accumulations. 4) Improve the water quality benefit of existing storm water system clean-up programs. 5) Improve the water quality benefit of existing street sweeping programs

Potential Problem	Possible Causes or Locations of "Problems"	Control Measure Options	Discussion of Criteria for Selection	Recommendations for Initial Plan
B. Erosion and runoff Control	Possible Causes: 1) Poor land management; poor tillage; overgrazing; construction practices. 2) Erodable, unstable soils. 3) Increased runoff due to development. Locations: Possible wherever one of the above conditions is present. Specific problem areas are not compiled but areas where most conditions are met are on the Coast, developable Bayside hills and isolated, exposed soils (quarries, road cuts).	ABAG List: B. Measures to reduce amount of pollutants and the Peak Flow or Volume of Runoff. (See Appendix B for further description) B-1. Prevent direct roof drainage B-2. Detain rain on rooftops. B-3. Direct runoff away from contaminated areas. B-4. Retain runoff from contaminated areas. B-5. Impound runoff in upstream channels B-8. Regrade disturbed areas B-10 Stabilize channels and banks B-12 Enhance surface retention & infiltration B-15 Control erosion at construction sites C. Measures to treat and store runoff C-1 Treatment and storage of runoff	Criteria #1: Existing Practices Present controls for erosion and drainage are embodied in numerous government policies: grading, quarry, timber harvesting, zoning, subdivision ordinances, EIR guidelines, Resources Conservation District & Farm Advisor guidelines, general plan elements & public works policies and projects. Specific provisions of all these policies for all jurisdictions are not presently known. Criteria #2: Existing Interest Areas where interest would be greatest for examining and possibly improving such practices are those areas where possibility for impact still remains - the Coast and Bayside hills. Criteria #3: Multiple Benefits Multiple benefits could be realized by concentrating on the unincorporated coastal area in the near future, because of a pending large-scale study of all County regulations which affect the coastal area to determine conformance with the Coastal Act. Criteria #4: Widespread Application Application of any of the measures on the ABAG list could be considered in a study of the coastal area erosion and runoff control practices. When they are analyzed in more detail in such a study, applicability for other areas will be better known.	1) Determine more clearly the locations of significant erosion and siltation. 2) Examine and improve, where feasible, existing erosion and runoff control practices in the unincorporated coastal area. 3) Encourage improvement of existing practices in other areas in the County.

Potential Problem	Possible Causes or Locations of "Problems"	Control Measure Options	Discussion of Criteria for Selection	Recommendations for Initial Plan
C. Sewer line infiltration and sewer failures.	High infiltration of stormwater due to sewer line disrepair, poor sewer design (manhole covers, back-up pumps), or direct, illegal connections.	ABAG List: A-10. Eliminate cross-connections with sanitary sewers. (See Appendix for further description) Other: -Increased aid for Infiltration, Inflow Analysis (I&I). -Increased aid for sewer line repair and replacement.	Criteria #1: Existing Practices Several cities have received I&I study grants to investigate the sources of infiltration and locations of any cross-connections. Many other cities, however, need to undertake such studies, but do not have the necessary local resources. Sewer line replacement and repair is often a difficult item to get budgeted by local communities. Criteria #2: Existing Interest Interest is generally high among local City staffs because they are aware of the strain infiltration can place on treatment plants & sewer lines, and of the threat of contamination if they fail. Eliminating the problems, however, requires adequate initial study. Criteria #3: Multiple Benefits Increased study of sewer lines could help local governments develop a sound program for repair and replacement of lines and removal of cross-connections. Increased aid could help local governments address these problems. Criteria #4: Widespread Applicability Infiltration is a problem in almost all jurisdictions. While several have initiated studies of infiltration, they may still need aid in developing an action program.	1) Recommend a federal or state program of increased aid for infiltration/inflow analysis and for sewer line repair and replacement.

Potential Problem	Possible Causes or Locations of "Problems"	Control Measure Options	Discussion of Criteria for Selection	Recommendations for Initial Plan
D. Special Areas				
Bayside:		ABAG List:	Criteria #1: Existing Practices	1) Determine more clearly the sources, extent, and severity of "problem" areas.
1) Lagoons	Accumulations of debris; animal waste; siltation; oil; nutrients; poor circulation. Problems most directly affected by nearby development.	Any of the measures to reduce accumulation of pollutants prior to runoff or to control erosion may be applicable. Other measures (B-1; B-12; C-1) to reduce peak flows or volumes of runoff might have limited applicability. Other: -Education -Special Studies	A broad range of practices, either designed for general municipal benefits or particular to the lagoons, are undertaken by the cities involved. Educational efforts have been attempted by Foster City and Redwood City. Special studies of the problems have been undertaken by each city. Criteria #2: Existing Interest There is a high level of interest in educational programs focused on preventing indirect dumping. Generally there is a high level of interest in many activities which could be of benefit: new technology for aeration; new techniques for algae control. Criteria #3: Multiple Benefits Most of the existing practices have some multiple benefit. Education could help reduce present clean-up costs. Criteria #4: Widespread Applicability Education in particular could be tried in these areas and, based on experience, expanded to benefit other areas.	2) Based on 1) above, develop an action program for solving documented problems. 3) See recommendations for Problem A, Accumulations of Debris and Vehicle Emissions.

Potential Problem	Possible Causes or Locations of "Problems"	Control Measure Options	Discussion of Criteria for Selection	Recommendations for Initial Plan
2) Coyote Point Shellfish Beds	Unknown. Nearby storm drains may provide nutrients and silt which allow the bed to exist, but may contribute some bacteria or other contaminants. Beds are very small, ±60 square feet.	Unknown. Further study is needed. Options include -- o Continued County Health Dept. and/or other agency monitoring designed to identify the source and extent of problem o Depending on results of efforts, develop control measure options.	<u>Criteria #1</u>: <u>Existing Practices</u> Periodic monitoring of shellfish beds. <u>Criteria #2</u>: <u>Existing Interest</u> Because the shellfish beds have shown such dramatic improvements in recent years, even before the new sewage treatment plants are in place, concern is moderate. The beds have been meeting the required standards for much of the year. The new sewage treatment plants may well solve any remaining problems. <u>Criteria #3</u>: <u>Multiple Benefits</u> Public health, shellfishing industry, and recreational benefits could accrue from continued or increased monitoring and potential problem identification, and any further abatement activities. <u>Criteria #4</u>: <u>Widespread Applicability</u> A study approach which helps to isolate particular problem sources and controls could be used elsewhere.	1) Determine more clearly the sources, extent, and severity of this problem area. 2) Based on the above, develop an action program for solving documented problems.

Potential Problem	Possible Causes or Locations of "Problems"	Control Measure Options	Discussion of Criteria for Selection	Recommendations for Initial Plan
Coastside:				
1) San Pedro Creek	Varied--illegal discharges, stream alterations, cross-connection, and low flows in summer. Possible animal contaminations have been suggested.	Unknown. Further study is needed.	<u>Criteria #1</u>: <u>Existing Practices</u> Not completely known. California Fish and Game, the Cities of Pacifica and Half Moon Bay, and County Health Department have pursued some efforts at problem identification. <u>Criteria #2</u>: <u>Existing Interest</u> Problems are relatively small in scope, but because these are fishable streams, problem areas #1 & #2 are California Fish and Game's top two priorities for the County. <u>Criteria #3</u>: <u>Multiple Benefits</u> Further study could indicate means of improving the stream's quality with benefits for fishing, recreation, and possible vector and drainage control. <u>Criteria #4</u>: <u>Widespread Applicability</u> A study approach which helps to isolate particular problem sources and controls could be used elsewhere.	1) Determine more clearly the sources, extent, and severity of this "problem" area. 2) Based on the above, develop an action program for solving documented problems.
2) Frenchman's Creek	Drainage from stable is suspected. Extent of problem is unknown.			
3) Pillar Point & Martin's Beach shellfish beds	Drainage from creeks & storm drains could be resulting in both positive (nutrients, silt) and negative (bacteria, heavy metals) impacts.			

APPENDIX D
GLOSSARY

APPENDIX D
GLOSSARY OF TECHNICAL TERMS*

Algae	Any of numerous chlorophyll-containing plants of the phylum thallophyta that grow in either sea water or fresh water; seaweeds and pond scum are algae.
Bacteria	A single-celled micro-organism without a nuclear membrane capable of sexual reproduction.
Base Flow	Stream discharge derived from groundwater sources. Sometimes considered to include flows from regulated lakes or reservoirs. Fluctuates much less than storm runoff.
BOD_5	Five-day Biochemical Oxygen Demand: A standard test for the amount of oxygen utilized in aerobic decomposition of a waste material during a five-day incubation at a specified constant temperature.
Calibration	The procedure of assigning values to the uncertain or unknown parameters in simulation model and adjusting them until model predictions correspond acceptably with observed prototype behavior.
Catch Basin	A chamber or well, usually built at the curb line of a street, for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.
Concentration	The quantity of a given constituent in a unit volume or weight of water.
Dissolved Solids	The total amount of dissolved material, organic and inorganic, contained in solutionin water or wastes.
D.O.	Dissolved oxygen, the amount of gaseous oxygen dissolved in a liquid sample.
Drainage Basin	A geographical area or region which is so sloped and contoured that surface runoff from streams and other natural watercourses is carried away in a single drainage system by gravity to a common outlet or outlets; also referred to as a watershed or drainage area.
Dry Weather Flow	The combination of sanitary sewage, and industrial and commercial wastes normally found in the sanitary sewers during the dry weather season of the year. Also, that combination of flow in streams during dry seasons.

* Taken from Surface Runoff Brief #2, ABAG, June 22, 1977

Eutrophi-cation — The progressive enrichment of surface waters particularly non-flowing bodies of water such as lakes and ponds with dissolved nutrients, such as phosphorous and nitrogen compounds, which accelerate the growth of algae and higher forms of plant life and result in the utilization of the useable oxygen content of the waters at the expense of other aquatic life forms.

Fecal — Fecal coliform are indicators of human and animal pollution and are expressed as numbers of bacteria per volume of sample.

First Flush — The condition, often occurring in storm sewer discharges and combined sewer overflows, in which a disproportionately high pollution load is carried in the first portion of the discharge or overflow.

Floatables — Litter, debris, oil and grease.

Heavy Metals — Metallic elements with high molecular weights, generally toxic in low concentrations to plant and animal life. Examples are: mercury, chromium, cadmium, arsenic and lead.

Hydrograph — A flow versus time graph derived from direct measurement of runoff.

Loading — The dry weight, in pounds, of some material that is being added to a process or disposed.

Nitrate — A form of nitrogen which is an essential nutrient to plants (can cause algal blooms if all other nutrients are present in sufficient quantities). Product of bacteria oxidation of other forms of nitrogen, from the atmosphere during electrical storms and from fertilizer manufacturing.

Nitrogen — Usually ammonium, nitrite, and nitrate ions, and certain simple amines are available for plant growth. A small fraction of organic or total nitrogen in the soil is available at any time.

Nonpoint — A pollution which enters a water body from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.

Nutrients — Substances essential to biological growth.

Organics — Materials composed of carbon, hydrogen and oxygen (CH_2O).

Overflow — A pipe line or conduit device together with an outlet pipe that provides for the discharge of portions of combined sewer flows into receiving waters or other points of disposal, after a regulator device has allowed the portion of the flow which can be handled by interceptor sewer lines and pumping and treatment facilities to be carried by and to such water pollution control structures.

Outfall	The point, location, or structure where wastewater or drainage discharges from a sewer to a receiving body of water.
Point Source Pollution	"The term 'point source' means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation vessel or other floating craft, from which pollutants are or may be discharged."
Pollutant	"The term 'pollutant' means dredged spoil, solid waste, incincerator residue, sewage, garbage, sewage sludge, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water."
Pollutograph	A graph of pollutant concentration as a function of time during a rainfall/runoff event.
Residual	Those solid, liquid, or sludge substances from man's activities in the urban, agricultural, mining and industrial environment which are not discharged to water after collection and necessary treatment.
Runoff	That portion of the precipitation on a drainage area that is discharged from the area in stream channels.
Runoff Coefficients	Fraction of rainfall that appears as runoff after subtracting depression storage and interception. Typically accounts for infiltration into ground and evaporation.
Sedimentation	The process of subsidence and deposition of suspended matter carried by water, sewage, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point where it can transport the suspended material.
Surface	Precipitation that falls onto the surfaces of roofs, streets, ground, etc., and is not absorbed or retained by that surface, thereby collecting and running off.
TDS	Total Dissolved Solids. The dissolved salt loading in surface and subserface waters.
Watershed	The region drained by or contributing water to a stream, lake, or other body of water.
Wet Water Flow	A combination of dry weather flows, infiltration, and inflow which occurs as a result of rainstorms.

REFERENCES

References

Eilers, J., Goldman, G., Litwin, Y, and Miller, B.J., Surface Runoff Brief #2, Pollution Problems, Association of Bay Area Governments, June 22, 1977.

San Mateo County Planning Division and PBQ&D, Inc., Examination of Existing Water Quality Problems in San Mateo County, Progress Report No. 9 to ABAG, April 19, 1977.

__________ Examination of Future Water Quality Problems in San Mateo County, Progress Report No. 13 to ABAG, June 7, 1977.

San Mateo County Planning Division, Draft San Mateo County Surface Runoff Management Plan, July, 1977.

Sartor, James D., and Boyd, Gail B., Water Pollution Aspects of Street Surface Contaminants, prepared for U. S. Environmental Protection Agency, EPA-R2-72-081, November, 1972.

ADDENDUM #1

SAN MATEO COUNTY SURFACE RUNOFF MANAGEMENT PLAN

(A Portion of the Bay Area 208 Environmental Management Program)

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PLANNING DIVISION • COUNTY OF SAN MATEO • OCTOBER, 1977

ADDENDUM #1:

COUNTY, CITY, AND DISTRICT ACTIONS ON FINAL DRAFT

TABLE OF CONTENTS

ACTIONS RECEIVED AFTER OCTOBER 1977 WILL BE TRANSMITTED SEPARATELY

1. SUMMARY OF LOCAL ACTIONS ON FINAL DRAFT

Summary of Local Actions and Concerns:
Final Draft San Mateo County Surface Runoff Management Plan

The 19 cities in San Mateo County and two special districts were requested to formally review the San Mateo County Runoff Plan and indicate their approval of the Plan by resolution. Recommendations which they wished to make regarding the Plan were to be included as part of their resolutions. Local jurisdictions were informed that their recommendations would be incorporated into this official Addendum to the Surface Runoff Plan. This Addendum will serve to guide plan implementation and enforcement.

This Addendum includes all official actions taken by local jurisdictions and received by October 29, 1977. Local actions received after that time will be transmitted to the Association of Bay Area Governments (ABAG) for inclusion in the document. These additional actions will be available to other jurisdictions or parties on request.

In general, the Plan has been well-received. A majority of local jurisdictions have approved the Plan by resolution; and staff reports for those jurisdictions which are scheduled to take action have been favorable. There have been some consistent concerns expressed by many local jurisdictions.

The recommendations made by the cities reviewing or approving the Plan are important to highlight. These issues are:

- <u>Plan Enforcement and Implementation</u>. City and applicable district staffs have generally been quite favorable toward the program of actions recommended in the Draft Surface Runoff Plan. However, there continues to be concern about the eventual enforcement and implementation of the Surface Runoff Plan as well as the entire 208 Environmental Management Program.

  Local jurisdictions want to be involved in any decisions regarding these issues in order to assure that local needs and problems will be considered.

  Some jurisdictions believe that this decision making process should be vested in a restructured regional government that consolidates special purpose agencies and then opens up more decisions to the ABAG General Assembly. Other jurisdictions believe that the County government is the best framework for assuring that local concerns will be heard. Still others believe that the special purpose agencies, such as the Regional Water Quality Control Board, understand local problems and have the technical competence to assure realistic planning and decisions.

  The County's Surface Runoff Plan calls for local control over plan implementation, review and annual update. This local process will be defined even more clearly by January, 1978, based on local jurisdiction recommendations. The issues regarding regional, State or federal responsibilities for this Plan or the entire EMP cannot be decided quickly. Therefore, the San Mateo County Board of Supervisors has urged all local jurisdictions to take a lead in the negotiations on these issues in the coming months.

- Problem Definition. Some cities are concerned about a long-term program for surface water runoff when the problems identified to date are relatively isolated and the cause and effect relationships of pollution sources and water quality problems are hard to document.

  The planning program, as outlined, is geared to this level of problem identification. The Plan is not a stringent program, because the problems are not known to be severe. Importantly, it requires an annual reassessment of the problems and program.

  The Plan should perhaps have emphasized more strongly that this annual reassessment can be considered a "circuit-breaker." That is, at some point, based on further problem identification, we may find that continued planning and coordination are no longer needed because problems have already been solved or best management practices have been instituted.

- Financial Commitments. Cities have agreed to the Year One Work Program commitments of staff time which were identified in detail in the Plan. Many are concerned, however, about the level of financial commitments which may be needed to implement recommendations developed in more detail during the Year One Program.

  The Plan indicates that these recommendations will be developed locally and that the annual review will require investigation of outside funding resources. The Plan should perhaps have stressed more strongly that outside funding assistance will be needed for any increased levels of services which may be recommended during the planning program.

- Priorities. A few jurisdictions believe that the work program priorities should emphasize different problem areas. These concerns can be easily accommodated in developing the specific work program for special area studies.

GF:ps

2. RESOLUTIONS AND RECOMMENDATIONS BY LOCAL JURISDICTIONS

Board of Supervisors

COUNTY OF SAN MATEO

COUNTY GOVERNMENT CENTER · REDWOOD CITY · CALIFORNIA 94063

Eileen Kenyon White
EXECUTIVE OFFICER

(415) 364-5600 EXT. 4566

October 25, 1977

Supervisor Diane Feinstein, Chairperson
Environmental Management Task Force
Association of Bay Area Governments
Hotel Claremont
Berkeley, CA 94705

Dear Supervisor Feinstein:

On October 11, the San Mateo County Board of Supervisors adopted the enclosed resolution approving the Final Draft San Mateo County Surface Runoff Management Plan for transmittal to the Association of Bay Area Governments and incorporation into the Environmental Management Plan.

The Board directed that all city and district resolutions and recommendations be included in an official addendum to the Final Draft and that the concerns expressed by local jurisdictions be highlighted in this addendum. This addendum will be transmitted shortly. The attached summary of local jurisdiction actions and recommendations is provided for your review at this time.

In approving the Final Draft for transmittal to ABAG, the Board requested that significant proposals affecting the content or enforcement of the plan suggested by ABAG or other reviewing agencies be brought before the County for local review.

The Board reaffirmed that approval of the 208 Surface Runoff Management Plan does not relinquish local jurisdiction to ABAG or any other governmental agency.

In addition, the Board indicated that any increase in costs to local agencies for implementation of the Plan must be borne by the enforcement agency.

Recognizing that many of the issues regarding eventual plan implementation and enforcement have not been resolved, the Board has urged local jurisdictions to assume a lead role in the continuing discussions on plan enforcement among local, regional, State and federal agencies.

Respectfully submitted,

John M. Ward

John M. Ward, Chairman
San Mateo County Board of Supervisors

RESOLUTION NO. 037849

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

WHEREAS, we, the San Mateo County Board of Supervisors have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we have found it to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, recommendations made by jurisdictions in San Mateo County for modifications to this Final Draft will be included in an addendum to this Draft and these recommendations will guide decisions on plan implementation, enforcement and annual plan update:

NOW, THEREFORE, we approve the Final Draft San Mateo County Surface Runoff Management Plan and Addendum for transmittal to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

Regularly passed and adopted this 11th day of October, 19 77.

AYES and in favor of said resolution:

Supervisors: JAMES V. FITZGERALD

JOHN M. WARD

EDWARD J. BACCIOCCO, JR.

FRED LYON

NOES and against said resolution:

Supervisors: NONE

Absent Supervisor: WILLIAM H. ROYER

John M. Ward
Chairman, Board of Supervisors
County of San Mateo
State of California

ATTEST:

Eileen Kinnan White
Clerk of said Board of Supervisors
(SEAL)

TOWN OF ATHERTON
91 ASHFIELD ROAD
ATHERTON, CALIFORNIA 94025
(415) 325-4457

October 28, 1977

San Mateo County Board of Supervisors
County Government Center
Redwood City, California 94063

Gentlemen:

Enclosed please find copy of Resolution No. 1381, Resolution Approving The Final Draft Runoff Plan for Incorporation In The Environmental Management Plan which was adopted by the City Council of the Town of Atherton, October 25, 1977.

Sincerely,
Town of Atherton

Jack D. Farrell
City Manager

JDF/pf

Encl: Res. No. 1381

RESOLUTION NO. 1381

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

WHEREAS, WE, the City Council of the Town of Atherton have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we have found it to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update:

NOW, THEREFORE, we approve the Final Draft Runoff Plan with our attached recommendations for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

PASSED AND ADOPTED by the City Council of the Town of Atherton this 25th day of October, 1977 by the following vote:

AYES: Councilmen: Theodore F. Nell
Leroy Hubbard
Malcolm Dudley
John W. Dinkelspiel
Reynolds Smith

NOES: Councilmen: None

ABSENT: Councilmen: None

Reynolds Smith

Mayor, Town of Atherton

ATTEST:

[illegible signature]

City Clerk, Town of Atherton

CITY of BELMONT

1365 Fifth Avenue
Belmont, California 94002
~~(415) 592-8101~~ 573-2790

Office of: City Clerk

October 4, 1977

Honorable Members
Board of Supervisors
County Government Center
Redwood City, CA 94063

c/o Ms. Geri Forman, Coordinator
County Planning Department

Gentlemen,

Enclosed is a copy of Belmont Resolution No. 4714 approving the San Mateo Final Draft Surface Runoff Management Plan, being a portion of the Bay Area 208 Environmental Management Program, produced by the Department of Environmental Management, Planning Division, San Mateo County and dated September 1977, for incorporation into the Environmental Management Plan.

Very truly yours,

James W. McLaughlin

James W. McLaughlin, CMC
Belmont City Clerk

JMcL/jo
encl:
cc: D. Macris, Assoc. Director
Association of Bay Area Governments

RESOLUTION NO. 4714

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

RESOLVED by the City Council of the City of Belmont that it does hereby approve the attached final draft runoff plan for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Environmental Management Plan.

§ § § § § § §

I hereby certify that the foregoing Resolution was duly and regularly passed and adopted by the City Council of the City of Belmont at a regular meeting thereof held on September 26, 1977, by the following vote:

AYES, COUNCILMEN: Worthge, Ketcham, McInerney, Hardwick, Gonsalves

NOES, COUNCILMEN: None

ABSTAIN, COUNCILMEN: None

ABSENT, COUNCILMEN: None

James W. McLaughlin

CLERK of the City of Belmont

APPROVED:

MAYOR of the City of Belmont

RESOLUTION NO. 77-73

BRISBANE CITY COUNCIL RESOLUTION
APPROVING THE FINAL DRAFT RUNOFF PLAN FOR
TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS
AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR
INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

WHEREAS, the Brisbane City Council has reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, it has been found to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, the city of Brisbane understands that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations which deal with deleting references to Guadalupe Valley Area Plan and the commitment of city staff time, will guide implementation and annual plan update:

NOW, THEREFORE, the Final Draft Runoff Plan is approved for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

Paul F. Goercke

PAUL F. GOERCKE
Mayor

I, the undersigned, hereby certify that the foregoing Resolution No. 77-73 was duly and regularly passed and adopted by the Brisbane City Council at a regular meeting held thereof on September 26, 1977, by the following vote:

Ayes: BRADSHAW, HODGE, MILLER, THOMPSON and GOERCKE

Noes: None

Absent: None

RICHARD B. KERWIN
City Clerk

"CERTIFIED A TRUE COPY"

Dep. M. K. [illegible]
CITY CLERK, CITY OF BRISBANE

Recommendations for modification of Final Draft of San Mateo County Surface Runoff Management Plan:

1. There are several references in the Final Draft to the "Guadalupe Valley Area Plan" which should be changed to reflect the area under study which is the Brisbane Lagoon Watershed. The Final Draft indicates that this plan has been required by the Board of Supervisors and that it is to be comprehensive and cover land use, circulation and environmental management. While it is true that the Board of Supervisors did require this plan to be developed, it is with the understanding that this would be a joint venture effort with the County, the City of Brisbane, Quarry Products, Inc., Visitacion Associates and Crocker Land Company participating. To date only one organizational meeting has been held to which the City of Daly City was inappropriately invited and at which Visitacion Associates indicated quite strongly that land use would not be a part of the study. The point we are making here is that it is premature to count on this study actually developing into reality and so references to it should be made in a tentative vein and the area under study is the Brisbane Lagoon Watershed rather than just Guadalupe Valley--a name we believe was chosen for political purposes which show a detachment from any relationship to the City of Brisbane.

2. The City of Brisbane is willing to contribute approximately 44 hours to plan implementation as set forth in the Final Draft for the first year work program, however, the dollar amount of local share will be less than forecast because Brisbane pays its management less than other cities.

OFFICE OF THE CITY CLERK
CITY OF DALY CITY
SULLIVAN AVENUE AND 90TH STREET
DALY CITY, CALIFORNIA 94015

PHONE (415) 992-4500
EXTENSION 217

ANNA OHLENDORF
CITY CLERK

October 26, 1977

Honorable Board of Supervisors
County Government Center
Redwood City, California 94063

Dear Members of the Board:

Enclosed for your action is a copy of Resolution No. 77-277, Approving the Final Draft Runoff Plan for Transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for Incorporation in the Environmental Management Plan.

Very truly yours,

Anna Ohlendorf

ANNA OHLENDORF CMC
City Clerk

AO/bm
Encl.

cc: Ms. Geri Farman, 208 Coordinator
County of San Mateo
Department of Environmental Management
County Government Center
Redwood City, CA 94063

RESOLUTION NO. 77-277

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF DALY CITY APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

BE IT RESOLVED by the City Council of the City of Daly City, as follows:

1) The City Council of the City of Daly City has received and reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September 1977; and

2) It finds said Plan to be a satisfactory program to address surface runoff management in San Mateo County; and

3) It is the understanding of this City Council that its recommendations for modifications to this Final Draft will be included in an addendum to said Draft and that these recommendations will guide plan implementation and annual plan update,

NOW, THEREFORE, the City Council of the City of Daly City hereby approves the Final Draft Runoff Plan with its recommendations, copy of which recommendations is attached hereto, marked Exhibit "A" and by this reference made a part hereof, for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

I hereby certify the foregoing to be a true copy of a Resolution adopted by the City Council of Daly City, California, at a regular meeting thereof held on the 25th day of October, 1977, by the following vote of the members thereof:

AYES, and in favor thereof, Councilmen: Giammona, Kyriakis, Schumacher, Stewart, Teglia

NOES, Councilmen: None

Absent, Councilmen: None

Anna Ohlendorf
CITY CLERK OF THE CITY OF DALY CITY

APPROVED:

ALBERT M. TEGLIA
MAYOR OF THE CITY OF DALY CITY

MAYOR
WILLIAM J. SCHUMACHER
MAYOR PRO TEMPORE
ANTHONY A. GIAMMONA
VICTOR O. KYRIAKIS
ROBERT L. STEWART

DAVID R. ROWE
CITY MANAGER
ANNA OHLENDORF
CITY CLERK
ANTHONY J. ZIDICH
CITY TREASURER

PHONE (415) 992-4500
EXTENSION 201

OFFICE OF THE CITY MANAGER

CITY OF DALY CITY

SULLIVAN AVENUE AND 90TH STREET

DALY CITY, CALIFORNIA 94015

October 5, 1977

Ms. Geri Farman, 208 Coordinator
County of San Mateo
Department of Environmental Management
County Government Center
Redwood City, CA 94063

Dear Ms. Farman:

The Daly City City Council has not reviewed the "Final Draft Surface Runoff Management Plan" in detail. A committee of two councilmen has been appointed to review the plan with city staff.

Based on your presentation at the City Council study session on October 3, 1977, the City Council is in general agreement with the plan as you described it. The City Council does have concerns in how the plan will be implemented and what effect that will have on the city. They also are concerned on how the plan will be enforced and funded. Any mandated programs or regulations that do not have related funding sources are very difficult to implement without significant effects on local government operations and financial capabilities.

Staff review of the plan indicates that Daly City's involvement on a "local basis" would be in the area of "potential nonpoint pollution sources." Daly City has a Clean Community Committee that was formed to eliminate litter and debris from city streets, sidewalks, and so forth. A major part of this committee's effort will be in the area of public education. It may be possible to incorporate surface runoff considerations in the committee goals and objectives. The education program directed at litter and debris problems could be expanded to deal with surface runoff pollution.

The Committee has reviewed Daly City's litter and dumping ordinances and made recommendations for expanding those ordinances and making them more specific and enforceable. The current litter ordinances are very difficult to enforce.

The following is a description of our city street sweeping program:

1. The current Daly City Plan is street sweeping in residential areas once a week. In the commercial district bordering Mission Street, the street sweeping is accomplished daily, Monday through Friday. In most shopping centers, street sweeping is done by the center.

2. Higher levels of street sweeping service would be dependent upon availability of funds. The current budget will not support more sweeping.

3. Cooperative street sweeping service would probably not help Daly City. We have a maintenance agreement with CalTrans to sweep Highway 82 (Mission Street) in this city.

4. Daly City has plans to develop restricted parking to help the street cleaning schedule. The first such location is Mission Street with restricted parking daily during early morning hours.

5. Daly City is currently using two fine particle pickups (vacuum units). Description: Tymco Air Sweeper, Model 600. The City has more than one year of experience with these machines. It is planned to replace them with similar equipment at the end of their economical life.

6. Sweeping service will be maintained year round except in heavy rains when sweeping is curtailed. The most productive technique found for street sweeping is the proper advance layout of routes for the sweeping.

The above is a brief description of two city programs that relate closely to the surface runoff plan. We anticipate that these programs will continue at their current level unless there are financial changes in the City's funding level.

These comments are based on a staff review of the surface runoff plan and City Council general observations. Specific comments will be made by a City Council Committee after the surface runoff plan has been reviewed in detail.

Very truly yours,

Ronald L. Mitchell

Ronald L. Mitchell
Assistant to the City Manager

RLM:cj

City of Foster City

ESTERO MUNICIPAL IMPROVEMENT DISTRICT

610 FOSTER CITY BLVD.
FOSTER CITY, CA 94404
(415) 349-1200

OFFICE OF THE CITY CLERK

October 20, 1977

San Mateo County Board
of Supervisors
401 Marshall Avenue
Redwood City, California 94063

Gentlemen:

Enclosed for your information and records is a certified copy of Resolution No. 1402, approving the Final Draft, San Mateo County Surface Runoff Management Plan of September, 1977, which was adopted by the Board of Directors at its regular meeting of October 17, 1977.

If you have any questions, please do not hesitate to call.

Sincerely,

Marvell L. Herren

Marvell L. Herren
Assistant District Secretary

Enclosure

RESOLUTION NO. 1402

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE ESTERO MUNICIPAL IMPROVEMENT DISTRICT APPROVING THE FINAL DRAFT, SAN MATEO COUNTY SURFACE RUNOFF MANAGEMENT PLAN OF SEPTEMBER 1977

ESTERO MUNICIPAL IMPROVEMENT DISTRICT

BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE ESTERO MUNICIPAL IMPROVEMENT DISTRICT, as follows:

WHEREAS, the Department of Public Works has reviewed the Final Draft, San Mateo County Surface Runoff Management Plan and has submitted a report to this Board;

WHEREAS, this Board recognizes the need for and supports an effective storm water management program; and

WHEREAS, this Board has reviewed the Final Draft and report and found the plan to satisfactorily address the need for an effective surface runoff management program.

NOW, THEREFORE, BE IT RESOLVED, that the Board of Directors of the Estero Municipal Improvement District does hereby approve the Final Draft, San Mateo County Surface Runoff Management Plan and directs the District Secretary to send a certified copy of said resolution to the County Board of Supervisors and the Association of Bay Area Governments.

PASSED AND ADOPTED as a resolution of the Board of Directors of the Estero Municipal Improvement District at the Regular Meeting held on the 17th day of October, 1977, by the following vote:

AYES: Directors Chavez, Gilbert, Kruss, Zimmerman and President Matsuo

NOES: None

ABSENT: None

ABSTAIN: None

Kiyoshi Matsuo

KIYOSHI MATSUO, PRESIDENT

ATTEST:

Andrea M. Pavone

ANDREA M. PAVONE, DISTRICT SECRETARY

I hereby certify that the foregoing is a full, true and correct copy of the document it purports to be, which document is on file in the Office of the District Secretary.

Andrea M. Pavone 10/19/77

Andrea M. Pavone, Dist. Secy. Date

TOWN OF HILLSBOROUGH
SAN MATEO COUNTY

OFFICE OF
ROBERT M. DAVIDSON
CITY MANAGER
343-2795

1600 FLORIBUNDA AVE.
HILLSBOROUGH,
CALIFORNIA
94010

October 14, 1977

The Honorable John M. Ward, Chairman
San Mateo County Board of Supervisors
County Government Center
Redwood City, CA 94063

Dear Chairman Ward:

The Town of Hillsborough has adopted a Resolution Conditionally Approving the San Mateo County Final Draft Surface Runoff Management Plan, a copy of which is enclosed.

The conditions which are attached to the Resolution as "Exhibit A", I believe are self-explanatory.

I will be most pleased to discuss this with you if you so desire.

Very truly yours,

Robert M. Davidson
ROBERT M. DAVIDSON
CITY MANAGER

RMD/eg

Encl.

cc: Geri Foreman-w/Encl
208 Coordinator
Planning Dept.

RESOLUTION NO. 77-29

CONDITIONALLY APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN.

RESOLVED, by the City Council of the Town of Hillsborough, County of San Mateo, State of California, that

WHEREAS, we, the City Council of the Town of Hillsborough have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we have found it to be a basically satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update;

NOW, THEREFORE, we approve the Final Draft Runoff Plan, subject to the conditions set forth in Exhibit "A" attached hereto and by reference made a part hereof, with our recommendation to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

Regularly passed and adopted this 12th day of October, 1977, by the following vote:

AYES: Councilmen Clifton, Howard, Kelly ,Follett

NOES: Councilmen None

ABSENT: Councilmen Anderson

Barry N. Follett

MAYOR OF THE TOWN OF HILLSBOROUGH

ATTEST:

DEPUTY Virginia J. Heid

City Clerk

<u>EXHIBIT "A"</u>

The following conditions are hereby attached to the approving resolution for the Final Draft San Mateo County Surface Runoff Management Plan.

1. Recognizing the Plan requires local government to enter into an open-ended agreement for the elimination of potential storm run-off problems, submitting itself to the authority of a non-elected State Water Quality Control Board as the enforcement agency, the Town of Hillsborough conditions its approval upon the establishment of an elected agency such as the County Board of Supervisors or the General Assembly of ABAG as the enforcing agency.

2. Any mandated regulations should be appealable to a higher elected body responsible to the taxpayer.

3. Cost reimbursement should be required under the provision of SB 90 or similar federal legislation.

4. Extensive study should be conducted to determine whether "potential problems" are, in fact, problems of local concern. A cost/benefit study should be conducted to determine the economic and environmental impact, on the local taxpayer of solutions to those "<u>identified</u>" problems. Then and only then, can local government make an intelligent decision relating to those solutions.

5. Once the San Mateo County Board of Supervisors forwards its Plan to ABAG, any revisions, additions or deletions be returned to San Mateo County for review and comment before final adoption.

RESOLUTION NO. 94-77

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN.

WHEREAS, We, the City Council of the City of Half Moon Bay, have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September 1977, and

WHEREAS, We have found it to be a satisfactory program to address surface runoff management in San Mateo County, and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update;

NOW THEREFORE BE IT RESOLVED by the City Council of the City of Half Moon Bay that:

1. The Final Draft Runoff Plan is hereby approved in concept, with reservations to submit recommendations to the San Mateo County Board of Supervisors and the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

2. The City of Half Moon Bay's participation shall be limited to a contribution of approximately two hundred dollars ($200) to a lead agency and in-kind services by way of staff time for the one year and five year program.

3. Any further monitary or staff time participation shall be subject to the approval of the City Council of the City of Half Moon Bay.

* * * * * * * * * * *

PASSED AND ADOPTED by the Council of the City of Half Moon Bay, California, on October 18, 1977, at a regular meeting thereof, by the following vote:

AYES: Cardoni, Mello, Marmont

NOES: None

ABSENT: Adreveno, Alleman

Carl J. Marmont
Mayor

ATTEST:

City Clerk

ROBERT J. STEPHENS
MAYOR
JENNIFER BIGELOW
MAYOR PRO TEM
JAMES L. BLOCH
COUNCILMEMBER
IRA E. BONDE
COUNCILMEMBER
JAMES W. CALLOWAY
COUNCILMEMBER

CITY OF
MENLO
PARK

CIVIC CENTER / MENLO PARK, CALIFORNIA 94025 / TELEPHONE (415) 325-3211

October 26, 1977

Department of Environmental Management
County of San Mateo
County Government Center
Redwood City, California 94063

Attn: Ms. Geri Farman, 208 Coordinator

Subject: Final Draft - San Mateo County Surface Runoff Management Plan.

Dear Ms. Farman:

The Menlo Park City Council discussed the subject plan at their study meeting of October 18, 1977, and adopted a resolution approving the subject plan at their regular meeting of October 25, 1977. Transmitted herewith is a copy of the resolution which approved the plan for the Year One Program only and subject to the program addressing the following concerns:

The Council was concerned that the problems with San Francisquito Creek were not adequately addressed. The report only indicates that there has been some problems with fish kills when there has actually been a continuing problem with pollutants entering the creek from storm drains, especially from Stanford University, Stanford Shopping Center, and the Children's Convalescent Hospital. The Council feels that these problems should be a high priority in any program concerning surface runoff pollution problems. Since the creek is the boundary line between two counties and two cities, this has been a continual struggle to finding a solution to the problem. Therefore we feel that the San Francisquito Creek problems should be a high priority item for the Year One Program.

Otherwise, we are in agreement with the problem priorities and control measure activities outlined in the plan. Our Council desires to have the opportunity to review the Plan at the end of Year One and after more planning and identification of problem areas has taken place in order to determine where the two to five year program is leading.

If you have any questions or comments, please contact us at your earliest convenience.

Very truly yours,

Lauren E. Mercer

Lauren E. Mercer
City Engineer

RESOLUTION NO. 3015

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN.

WHEREAS, we, the City Council of the City of Menlo Park have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we have found it to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update;

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of Menlo Park that:

1. The final draft Runoff Plan is hereby approved in concept for the Year One Program only and with the understanding that our attached recommendations for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments will be incorporated in the San Mateo County and Bay Area Environmental Management Program.

2. The City of Menlo Park's participation shall be limited to a contribution of approximately Two Hundred Dollars ($200) to a lead agency and in-kind services by way of staff time for the one year program.

3. Any further monetary or staff time participation shall be subject to the approval of the City Council of Menlo Park.

4. Any programs that affect the City of Menlo Park beyond the Year One Program shall be subject to the approval of the City Council of Menlo Park.

I, MARGARET E. SNOWDEN, City Clerk of the City of Menlo Park, do hereby certify that the above and foregoing resolution was duly and regularly passed

and adopted at a regular meeting by said Council on the 25th day of October 1977, by the following vote:

AYES: Councilpersons: BIGELOW, BLOCH, BONDE, CALLOWAY and STEPHI

NOES: Councilpersons: NONE

ABSENT: Councilpersons: NONE

I further certify that the foregoing is a true and correct c of the original Resolution on file in the office of the City Cle Civic Center, Menlo Park, California.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Official Seal of said City, this 26th day of October 1977.

Margaret E. Snowden

Margaret E. Snowden
City Clerk

City of Millbrae
California

September 26, 1977

Board of Supervisors
County of San Mateo
County Government Center
Redwood City, California 94063

Gentlemen:

Attached you will find a Certified copy of Millbrae Resolution No. 77-105, which indicates our review and approval of the Final Draft of the San Mateo County Surface Runoff Management Plan.

Please note the attachment to the Resolution which indicates two concerns that the City of Millbrae has regarding the Plan that we wish to have incorporated into the overall Surface Runoff Plan that will ultimately be adopted for the San Francisco Bay Area as part of the Bay Area Environmental Management Program.

We appreciate the opportunity to provide comment and input regarding this portion of the Bay Area Environmental Management Program.

Sincerely,

Leland J. Horner
City Administrator

RECEIVED IN THE OFFICE OF THE CLERK OF THE BOARD OF SUPERVISORS
SEP 29 1977

LJH:ela

cc:
City Clerk

Ms. Geri Farman
208 Coordinator
County of San Mateo

Attachment

AGENDA ITEM NO. 2d

CERTIFIED COPY

RESOLUTION NO. 77-105

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF MILLBRAE APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

RESOLVED, by the City Council of the City of Millbrae, County of San Mateo, State of California, that

WHEREAS, the City Council of the City of Millbrae has reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977,

NOW, THEREFORE, IT IS HEREBY FOUND, ORDERED AND DETERMINED as follows:

1. The above described Plan is found to be a satisfactory program to address surface runoff management in San Mateo County, and based upon the understanding that the recommendations of the City of Millbrae, if any, for modifications to the Final Draft will be included in an addendum to the Draft, and that such recommendations will guide plan implementation and annual plan update, the City of Millbrae hereby approves the Final Draft San Mateo County Surface Runoff Management Plan, and the City Clerk is hereby authorized and directed to transmit the Plan, together with attached recommendations, if any, to the San Mateo County Board of Supervisors, and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

REGULARLY passed and adopted this 20th day of September, 1977.

ATTEST:

Arthur Lepore
Mayor

Marie Nickelson

Res. No. 77-105

I do hereby certify that the foregoing Resolution was duly and regularly passed and adopted by the City Council of the City of Millbrae this 20th day of September, 1977, by the following vote:

AYES, and in favor thereof:

COUNCILMEN: Bertini, Cannizzaro, Griffin, Lepore

NOES: COUNCILMEN: None

ABSENT: COUNCILMEN: Esser

Marie McKechnie

City Clerk

I hereby certify this to be a full, true and correct copy of the document it purports to be, the original of which is on file in my office.

Dated: Sept. 22, 1977

Alice Magellanes

Deputy City Clerk of the City of Millbrae

CITY OF MILLBRAE

ATTACHMENT

The following constitute the recommendations submitted by the City of Millbrae relating to the Final Draft of the San Mateo County Surface Runoff Management Plan prepared by the Department of Environmental Management, Planning Division, County of San Mateo.

1. The report lists areas of concern that have a potential of being impacted by storm water runoff. The report fails to comment upon the impact of storm water runoff into the San Francisco Water Department watershed area, specifically into the San Andreas/Crystal Springs Reservoir System. The San Andreas/Crystal Springs Reservoir System is used for storage of water that will later be consumed by the general public and this water should be free from all potential contaminants due to surface runoff. The report should address itself to any potential problems arising out of uncontrolled surface runoff into the aforementioned reservoir system. Mention should also be made of past efforts to control surface runoff into the reservoir system through the installation of pumping facilities adjacent to and built in conjunction with the construction of State Highway #280.

2. Table 7 of the Plan lists potential problems and the recommended Financial Mechanism to resolve these problems. The report suggests that most of the financial burden will fall upon local agencies. Local agencies cannot be expected to finance expensive solutions to surface runoff problems that, at best, may yield very minimal benefits. Where significant surface runoff problems are encountered, local agencies will have to look to the resources of the Federal Government for help in financing the solutions to such problems. The revenue limitations of local agencies simply would not allow local agencies to carry out costly surface runoff control measures.

   It is highly doubtful that there will be any significant amount of 208 monies remaining to pay for the cost of control measures. It is expected that most of the 208 monies will be used up in the planning effort.

The report should specifically identify those resources that will be made available to local agencies to cover the cost of control measures. Those agencies ultimately responsible for final solutions to the surface runoff management program should not presume that local agencies will be able to adequately finance the resolve of such solutions. As one of the local agencies, the City of Millbrae does not have the means to be able to finance surface runoff control measures. Mandated programs must be accompanied by adequate financial resources from sources other than local agencies. The report should identify those sources.

CITY HALL • 170 SANTA MARIA AVENUE • PACIFICA, CALIFORNIA 94044

CITY of PACIFICA INCORPORATED NOV 22 1957

355-4151

Scenic Pacifica

MAYOR
Sidney Lorvan

MAYOR PRO TEM
Mark Savage

COUNCIL
Stanley M. Farber
Janice Fulford
Nick Gust

CITY MANAGER
Donald G. Weidner

September 28, 1977

The Honorable John M. Ward, Chairman
San Mateo County Board of Supervisors
County Government Center
Redwood City, California 94063

Dear Chairman Ward:

The Pacifica City Council has adopted a resolution to approve the San Mateo County "Final Draft Surface Runoff Management Plan," as submitted.

The Council has many concerns about the underlying philosophy of the federal statute requiring the plan, the plan itself, and the implementation, enforcement, and funding of the plan. These concerns are reflected in the 3 to 2 vote on the plan. This letter states concerns which are shared by all the members of our Council.

We believe that it is necessary that the county and cities work together as closely as possible on the issues raised by the plan. The plan requires local government to enter into open-ended commitments for the elimination of alleged storm water runoff problems with power removed entirely from local government, leaving us only with the responsibility to carry out mandates and to tax our citizens to pay for them. If we do not work together, we shall be unable to prepare for the major potential difficulties we may all be facing.

We suggest that the county and cities consider designating the Association of Bay Area Governments (ABAG) as the sole agency to be responsible for the implementation, enforcement, and funding functions. We offer this recommendation because we believe that this may offer more opportunity for some degree of autonomy and self-determination for all levels of government within the Bay Area.

At the same time, ABAG's decision-making process, which primarily involves the Executive Committee, would need to be radically altered so that all major Environmental Management Plan matters involving implementation, funding, and enforcement would always be referred to its membership for ratification. Only in this way do we see a balance between effective regional environmental action

as required by the federal government, and continued self-determination by local government. We realize such a proposal has many far-reaching implications of its own and must be carefully studied. To not do so, in our opinion, leaves only the alternative of local government conducted by federal, state, and regional fiat with all its negative socio-economic, land use, and financial effects.

We believe that the next step will be comprehensive, regional environmental enforcement programs which the county and the cities will be subjected to without proper arrangements for administration and enforcement. Since the enforcement arrangements are unspecified, the powers of enforcement are unlimited. This dangerous precedent carries significant implications for local tax rates and ways of life as outside agencies can compel changes in municipal priorities to satisfy special interests. The multiplicity of agencies that may be involved leads to further concern about the possible diversion of local revenues. Consider what might come from, among others, the Environmental Protection Agency (Federal), California Water Resources Board and Department of Fish and Game, the San Francisco Regional Water Quality Control Board, and perhaps ABAG itself, to name only a few.

In a related concern, it is the Pacifica City Council's understanding that the EPA is planning to issue surface runoff discharge permits to many units of government in the Bay Area. These permits would be similar to wastewater treatment discharge permits now issued by EPA but, in this case, would "permit" the discharge of storm water runoff. Has anyone methodically thought out the financial, legal, and land use implications involved in accepting such permits? And what about the implications involved in the <u>withholding</u> or <u>withdrawal</u> of these permits?

The above concerns (which by no means are all-inclusive) are derived from examining only the proposed Surface Runoff Plan. There are six other major elements in ABAG's forthcoming Environmental Management Plan. They are:

1) Air Quality;
2) Municipal Facilities;
3) Industrial Facilities;
4) Minor Sources;
5) Water Conservation, Reuse and Supply: and
6) Solid Waste.

Any combination of implementing or enforcement actions from the seven major elements could cause sudden and radical shifts in our federal/state/local governmental relationships. More immediately, county and city financial, land use, and planning autonomy are likely to be seriously eroded.

Pacifica supports San Mateo County's Surface Runoff Plan in the form submitted to us. We also recognize the need to replace ineffective piecemeal environmental regulations and laws with more coordinated and effective environmental action in the Bay Area. At the same time, responsibility for the proper and equitable

use of the far-reaching authority attendant to any effective environmental management plan must be firmly and visibly fixed in one accountable agency. Without this, whether we are speaking of just one or all seven major elements of ABAG's Environmental Management Plan, local government will be pinned between powerful and competing enforcement agencies which are answerable to no one. Therefore, we propose that the San Mateo County Board of Supervisors, when submitting its Surface Runoff Plan, call for ABAG to be the regional implementation, funding, and enforcement agency. We further call for and respectfully request the Board of Supervisors' support for designating ABAG as the implementing, funding, and enforcement agency for the entire Environmental Management Plan, except wherever this would be contrary to federal law.

If the Board agrees with our position, we hope you will take the lead in presenting such a proposal to all Bay Area governments and the ABAG decision-makers.

Sincerely,

Sidney Lorvan

Sidney Lorvan
Mayor

Enclosure: Resolution No. 95-77

cc: City Council
Community Development & Services
Revan Tranter
Lou Shepard
San Mateo County City Managers
Press

bn

RESOLUTION NO. 95-77

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

WHEREAS, we, the City Council of the City of Pacifica have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we have found it to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update:

NOW, THEREFORE, we approve the Final Draft Runoff Plan with our attached recommendations for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

* * * * * *

Passed and adopted at a regular meeting of the City Council of the City of Pacifica held on the 26th of September, 1977.

AYES, Councilmen: Fulford, Savage, and Mayor Lorvan

NOES, Councilmen: Gust and Farber

ABSTAIN, Councilmen: None

ABSENT, Councilmen: None

Sidney Lorvan

Sidney Lorvan, Mayor

ATTEST:

Donald G. Weidner

Donald G. Weidner, City Manager/Clerk

TOWN of PORTOLA VALLEY

Town Hall and Offices: 765 Portola Road, Portola Valley, Calif. 94025 Tel. (Area Code 415) 851-1700

October 3, 1977

Geri Farman, 208 Coordinator
San Mateo Co. Plg. Div.
County Government Center
Redwood City, CA 94063

Dear Geri:

On September 28, the Town Council adopted the enclosed Resolution No. 715-1977, approving the Final Draft Runoff Plan for San Mateo County for transmittal to the Board of Supervisors and ABAG.

Regarding the various additional response requested from the Town, the Council was generally supportive of the program. However, it would not want to contribute any funds to a lead agency, nor to expend more than minimal in-house staff review time. It does not see a need for an upgraded street sweeping program within the Town, except for perhaps more frequent sweeping of the bike lanes.

Estimated staff time for this initial phase was 9 hours.

Sincerely,

Linda Craig

Linda Craig,
Town Clerk

LC:pb

RESOLUTION NO. 715-1977

A RESOLUTION OF THE TOWN OF PORTOLA VALLEY APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

RESOLVED, by the Council of the Town of Portola Valley, San Mateo County, California, that

WHEREAS, this Council has reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977;

WHEREAS, this Council has found it to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, this Council understands that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update;

NOW, THEREFORE, IT IS HEREBY FOUND and DETERMINED that this Council does approve the Final Draft Runoff Plan with our attached recommendations for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

* * * * *

I hereby certify the foregoing to be a full, true and correct copy of a resolution adopted by the Council of the Town of Portola Valley, California, at a meeting thereof held on the 28th day of September, 1977, by the following vote of the members thereof:

AYES, and in favor thereof, Councilmen: Boushey, Brown, Lockwood, Mitchell, Whitson

NOES, Councilmen: None

ABSENT, Councilmen: None

Clerk of the Town of Portola Valley

APPROVED:

Eleanor B. Boushey

Mayor

MINUTE ORDER

77-236

OFFICE OF THE CLERK, REDWOOD CITY, CALIFORNIA

DATE: November 8, 1977

Attention: City Manager
Public Works Director
Department of Environmental Management, Planning Division, County of San Mateo

In the Matter of: Section 208, Environmental Management Program - "Final Draft, San Mateo County Surface Runoff Management Plan, September 1977"

At the meeting of the Council of the City of Redwood City on November 7, 1977, at which were present

Councilmen: Barrett, Biagi, Bury, Norris, Rhodes, Vega and Mayor Leipzig;

on motion of Councilman Barrett, seconded by Councilman Bury, duly carried and entered on the minutes, it was ordered to approve the Final Draft of the San Mateo County Surface Runoff Management Plan with the understanding that any changes made to the Plan would require Redwood City's review and approval.

CITY CLERK

Jeh

City of San Bruno

567 EL CAMINO REAL
SAN BRUNO, CALIFORNIA 94066

OFFICE OF CITY CLERK
TERRI RASMUSSEN

TELEPHONE 589-9562
AREA CODE 415

October 27, 1977

Honorable Board of Supervisors
County of San Mateo
Government Center
Redwood City, California 94063

Association of Bay Area Governments
Hotel Claremont
Berkeley, California 94705
Attention: B. J. Miller

Re: Bay Area 208 Environmental Management Program
Final Draft San Mateo County Surface Runoff
Management Plan Dated September 1977

Gentlemen:

Please be advised that the San Bruno City Council unanimously adopted the following resolution at its October 24, 1977 meeting:

RESOLUTION 1977-85 Approving Final Draft Runoff Plan and Directing Transmittal Thereof to San Mateo County Board of Supervisors and Association of Bay Area Governments for Incorporation in Environmental Management Plan.

Enclosed herewith is a certified copy of said Resolution.

Thank you for your attention to this matter.

Yours very truly,

CITY OF SAN BRUNO

Terri Rasmussen

Terri Rasmussen
City Clerk

Enclosure

cc:✓ Ms. Geri Farman (w/enc)
Planning Department

RESOLUTION NO. 1977- 85

RESOLUTION APPROVING FINAL DRAFT RUNOFF PLAN AND DIRECTING TRANSMITTAL THEREOF TO SAN MATEO COUNTY BOARD OF SUPERVISORS AND ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN ENVIRONMENTAL MANAGEMENT PLAN

WHEREAS, the City Council of the City of San Bruno has reviewed the Final Draft San Mateo County Surface Runoff Management Plan dated September 1977; and

WHEREAS, said Council finds it to be a satisfactory program for surface runoff management in San Mateo County;

NOW, THEREFORE, IT IS HEREBY RESOLVED that the City Council of the City of San Bruno approves said Final Draft and directs the City Clerk to transmit a copy of this resolution to the San Mateo County Board of Supervisors and the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

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I hereby certify that the foregoing Resolution No. 1977-85 was duly introduced and adopted by the San Bruno City Council at a regular meeting held October 24, 1977 by the following vote:

AYES: COUNCILMEN Barnard, Governale, Griffith, Kozkowski, Mondfrans

NOES: COUNCILMEN None

ABSENT: COUNCILMEN None

Terri Rasmussen
CITY CLERK

CITY OF SAN CARLOS

City Clerk

Telephone (415) 593-8011

October 11, 1977

Ms. Geri Farman
208 Coordinator
County Planning Department
County Government Center
Redwood City, CA. 94063

Re: San Mateo County Surface Runoff Management Plan

Dear Geri:

Enclosed is certified copy of RESOLUTION NO. 1977-102 Resolution approving the final draft of the San Mateo County Surface Runoff Management Plan.

The City Council of the City of San Carlos passed and adopted the above Resolution at its meeting of September 26, 1977 with the recommendation that all reference to the Regional Water Quality Control Board as monitor or enforcer of the Plan be replaced with the County of San Mateo. This recommendation to be incorporated in the Bay Area Environment Management Plan.

A certified copy of the above Resolution was forwarded to ABAG Public Affairs Officer Kay Benjamin and to the San Mateo County Board of Supervisors for its determination.

Very truly yours,

Sadie M. Conboy

Sadie M. Conboy
City Clerk

Encl.

RESOLUTION NO. 1977 - 102

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

WHEREAS, we the CITY OF SAN CARLOS have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we have found it to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update:

NOW, THEREFORE, we the City Council of the City of San Carlos approve the Final Draft Runoff Plan with our attached recommendations for transmittal to the San Mateo County Board of Supervisors and to the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

* * * * * * *

I hereby certify that the foregoing Resolution was duly and regularly passed and adopted by the City Council of the City of San Carlos at a regular meeting thereof held on the 26th day of SEPTEMBER, 1977 by the following vote:

AYES, and in favor thereof,
COUNCILMEN: CALDERHEAD, DE ROSA, NOLAN, STEELE and KILBURG

NOES, and against,
COUNCILMEN: NONE

ABSENT, COUNCILMEN: NONE

Sadie M. Conboy
CLERK of the City of San Carlos

APPROVED:

James Kilburg
MAYOR of the City of San Carlos

I, SADIE M. CONBOY, duly appointed Clerk of the City of San Carlos and Ex-Officio Clerk of the Council, do hereby certify the attached Resolution No. 1977-102 is a true full and correct copy Resolution passed and adopted by the Council of the City of San Carlos at its regular meeting of Sept. 26, 1977

Sadie M. Conboy
CLERK OF THE CITY OF SAN CARLOS

DATE:
October 12, 1977

RESOLUTION NO. 169-77

CITY COUNCIL, CITY OF SOUTH SAN FRANCISCO, STATE OF CALIFORNIA

RESOLUTION APPROVING THE FINAL DRAFT RUNOFF PLAN FOR TRANSMITTAL TO THE SAN MATEO COUNTY BOARD OF SUPERVISORS AND TO THE ASSOCIATION OF BAY AREA GOVERNMENTS FOR INCORPORATION IN THE ENVIRONMENTAL MANAGEMENT PLAN

WHEREAS, we, the City Council of the City of South San Francisco, have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we have found it to be a satisfactory program to address surface runoff management in San Mateo County; and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update:

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of South San Francisco that:

1. The final draft Runoff Plan is hereby approved in concept, with reservations to submit recommendations to the San Mateo County Board of Supervisors and the Association of Bay Area Governments for incorporation in the Bay Area Environmental Management Program.

2. The City of South San Francisco's participation shall be limited to a contribution of approximately Two hundred dollars ($200) to a lead agency and in-kind services by way of staff time for the one year and five year program.

3. Any further monitary or staff time participation shall be subject

to the approval of the City Council of the City of South San Francisco.

*   *   *   *

I hereby certify that the foregoing Resolution was regularly introduced and adopted by the City Council of the City of South San Francisco at a *regular* meeting held on the *5th* day of *October*, 1977, by the following vote:

AYES, COUNCILMEN *Richard A. Battaglia, William A. Borba, Emanuele N. Damonte, Terry J. Mirri and Leo Padreddii*

NOES, " *None*

ABSENT, " *None*

ATTEST: */s/ Arthur A. Rodondi*

City Clerk

STATE OF CALIFORNIA } ss.
COUNTY OF SAN MATEO }

I, ARTHUR A. RODONDI, City Clerk of the City of South San Francisco, County of San Mateo, State of California, and ex-officio Clerk of the City Council thereof, do hereby certify that the above and foregoing is a full, true and correct copy of

Resolution No. 169-77

the original of which is on file in my office, and that I have carefully compared [illegible] with the original.

IN WITNESS WHEREOF I have hereunto set my hand and the seal of the City of South San Francisco this *6th* day of *October* 19*77*.

ARTHUR A. RODONDI
City Clerk and ex-officio Clerk of the City Council of the City of South San Francisco

By *Arthur A. Rodondi*
City Clerk

By
Deputy City Clerk

SAN MATEO COUNTY
MOSQUITO ABATEMENT DISTRICT
1351 ROLLINS ROAD
BURLINGAME, CALIFORNIA 94010
PHONE (415) 344-8592

RESOLUTION M-9-77

Approving the Final Draft Runoff Plan for Transmittal to the Association of Bay Area Governments for Incorporation in the Environmental Management Plan

WHEREAS, we, the Board of Trustees of the San Mateo County Mosquito Abatement District, have reviewed the Final Draft San Mateo County Surface Runoff Management Plan, September, 1977; and

WHEREAS, we understand that our recommendations for modifications to this Final Draft will be included in an addendum to this Draft and that these recommendations will guide plan implementation and annual plan update;

NOW, THEREFORE, BE IT RESOLVED that the Board of Trustees of the San Mateo County Mosquito Abatement District does hereby approve the Final Draft Runoff Plan with our attached recommendations for transmittal to the San Mateo County Board of Supervisors for incorporation in the Bay Area Environmental Management Program.

Adopted by the Board of Trustees of the San Mateo County Mosquito Abatement District on this 11th day of October 1977, in Burlingame, California.

Date: 11 October, 1977

Reynolds Smith
President

Arthur J. Lines
Secretary

SAN MATEO COUNTY
RESOURCE CONSERVATION DISTRICT
P.O. Box 128 · Half Moon Bay, California 94019 · Telephone: 726-4660

625 Miramontes Street, Suite 101

October 6, 1977

Board of Supervisors
County of San Mateo
Hall of Justice & Records
Redwood City, CA 94063

Gentlemen:

RE: Comments on Final Draft of 208 Surface Runoff Plan

The idea of singling out special areas for demonstrating the use and effectiveness of erosion control practices is good. The very Best Management Practices (as outlined to ABAG by the Bay Area Council of Resource Conservation Districts) on both urban and rural erosion problems is, and has been, the effort of the San Mateo County Resource Conservation District since its beginning. Our fullest cooperation in seeing this done can be counted on.

For many years we have realized that we and other Agencies have had some conflict over getting sound erosion measures "on the land". We wish to be in on the exploration of the problem areas to offer our views. Further, we hope that some guidelines, rather than mandates, can be set up for all the concerned Agencies to follow.

In your discussion regarding a stream corridor protection ordinance, was the idea of grazing control specific to stream areas, or to grazing in general? Implementation of grazing controls in streams would be much easier to get than overall grazing controls.

Our Technical Agency, the Soil Conservation Service, and the San Mateo County Farm Advisor's Office have been assisting the Brisbane Quarry owners. Since we are already involved, we would like to participate in the Brisbane Lagoon watershed study.

The San Mateo County Resource Conservation District has and uses what it considers to be the best management practices for curtailing erosion from all lands. Therefore, it is not improvement in erosion and runoff control practices that is needed, but wider spread implementation and use of these existing practices. In the past this has been an economic problem rather than a social (choice) problem. If financial motivation were provided for the implementation of the 208 Plan, it is possible more erosion work would be done on rural lands in San Mateo County. Urban erosion has not been a major problem within our District, but with only minor modification, our Ag. erosion practices can help control this problem.

Board of Supervisors
County of San Mateo

Because our staff time is limited, we would like a chance to review and comment on all studies, evaluations, etc. that would affect us and our district cooperators.

Except for our few minor comments, we feel that your 208 Surface Runoff Plan is excellent, especially in the parts that affect us directly. Congratulations.

Sincerely,

Fred E. Cunha

Fred E. Cunha, President
San Mateo County Resource Conservation District

FDC/d

DRAFT

Accepted by the Santa Clara County Board of Supervisors on 6 October 1977 for transmittal to the Association of Bay Area Governments

SURFACE RUNOFF MANAGEMENT PLAN
FOR SANTA CLARA COUNTY

CONTENTS:

INTRODUCTION

THE PLAN

APPENDICES (published as a separate document)

County of Santa Clara
Planning Department
September 19, 1977
Revised October 6, 1977

INTRODUCTION

Regional Environmental Management Plan

This Surface Runoff Management Plan for Santa Clara County will become part of a regional Environmental Management Plan (EMP) currently being prepared for the San Francisco Bay Area. The final plan will deal not only with surface runoff, but also with the air quality, water quality, water supply, and solid waste disposal for the region.

Preparation of the EMP is being coordinated by the Association of Bay Area Governments (ABAG) under a $4.3 million grant from U.S. Environmental Protection Agency (EPA) under the federal "208" Program.

The Environmental Management Plan Program is the most comprehensive effort of its kind ever undertaken in the Bay Area. More than 500 local, regional, state, and federal agencies are involved in one aspect or another of the plan preparation. This program provides the residents of the Bay Area and their elected officials with a unique, perhaps once-in-a-lifetime, opportunity to take action to maintain and enhance environmental quality in the San Francisco Bay Area for both present and future generations.

What Is "Surface Runoff"?

The term "surface runoff" refers to the rain water which runs off the land, rather than soaking into the ground. Surface runoff waters often carry with them various types of contaminants-things like oil and grease from streets and parking lots, sediment from construction sites, litter, animal wastes, pesticides, heavy metals such as lead from auto exhausts, pollutants washed out of the air, and various organic materials which use up oxygen as they decompose. When it rains, these materials are washed into gutters, storm drains, streams, flood control channels, reservoirs and San Francisco Bay.

What Is the Problem?

Throughout the preparation of this plan, a major issue has been "What specific impacts does surface runoff have on streams, reservoirs and San Francisco Bay and to what degree does it constitute a sufficiently serious problem to warrant major public action to reduce it?"

The answer to these questions remain largely unresolved. Efforts during the past year to gather more data to help answer these questions have been hindered by the lack of rainfall which has limited the amount of surface runoff water quality sampling that could be done and has cast some doubts on whether the data was representative.

It has been established that substantial amounts of silt and heavy metals are washed into receiving waters by surface runoff, but it is still not known exactly what adverse impacts they may have.

The Approach Taken in This Plan

Faced with this situation of uncertainty regarding any adverse impacts of surface runoff, there are several alternative approaches that could be taken. One would be to recommend that no action be taken until it has been conclusively proven that there are, in fact, significant problems which warrant further action. This "do nothing" approach has been rejected as being unrealistic for Santa Clara County where there are already many actions being taken to mitigate existing or potential problems.

The other extreme from the "do nothing" approach could be thought of as the "do everything" approach. That would involve taking all possible actions to mitigate existing or potential problems, even though the magnitude of these problems is not yet fully determined. This approach has also been rejected for Santa Clara County on the grounds that large expenditures of additional public funds are generally unwarranted until specific, serious adverse impacts from surface runoff have been identified.

The approach recommended in this plan lies somewhere inbetween these other two alternatives. Basically, it calls for 1. continuation of current local programs within the developed urban area to help reduce contaminants from surface runoff, 2. increased levels of effort in undeveloped and developing areas to reduce erosion and contaminants, particularly silt, 3. continuation of efforts to determine more precisely the nature and magnitude of existing and potential problems, and 4. continuation of efforts to evaluate the effectiveness of existing and possible alternative programs to achieve surface water quality enhancement in streams, reservoirs and the Bay.

Agencies Involved in Plan Preparation

The following agencies and groups participated in the preparation of the Surface Runoff Plan.

- Santa Clara Valley Water District - designated by ABAG as lead agency for preparation of the plan

- Metcalf & Eddy - (private consulting firm) - consultant hired by the Santa Clara Valley Water District to do the substantive work for the plan

- Santa Clara County Planning Department - designated by ABAG as the lead agency for the entire Environmental Management Plan and to conduct the public participation program for the Surface Runoff Plan

- "208" Technical Advisory Committee - (EMP-TAC) - a specially - created group established to provide technical review, policy guidance, and city liaison. Composed of the Public Works Directors (or representative) of each of the 15 cities, representatives from the County's Land Development Engineering, Health, and Planning Departments, representatives of each of the Resource Conservation Districts and Soil Conservation Service Staff. The TAC met quite often and provided the detailed technical review of each draft document.

- Santa Clara County Association of Planning Officials (SCCAPO) an existing committee of Planning Directors of the fifteen cities and the County, provided planning review and communication with city officials.

Plan Preparation Process

The major work items involved in the preparation of this plan included:

- Reviewing of existing water quality data
- Collecting and evaluating surface runoff samples
- Developing and analyzing computer model data related to surface runoff
- Defining existing and potential problems and their sources
- Assessing alternative control measures
- Coordinating plan preparation efforts with those of other local and regional agencies
- Preparing the plan document

The technical information relating to the preparation of this plan has been included in a separate Appendix document.

Selection of Recommended Control Measures

Approximately twenty different control measures are recommended in this plan. Most of these were selected from the list of approximately forty candidate control measures prepared by the Association of Bay Area Governments. In reviewing ABAG's list, the Technical Advisory Committee and the consultants used a number of criteria, including the following:

- Probable effectiveness
- Cost of implementation
- Relationship to identified problems
- Potential multiple benefits
- Probable political acceptability

Assessing the Impacts of the Plan

Included in the appendices of this plan is an assessment of the environmental, economic, social, and financial and institutional impacts of the plan, as requested by the Association of Bay Area Governments and the Environmental Protection Agency. The assessment indicates that the beneficial impacts of implementing the plan considerably outweigh any adverse impacts.

The impact assessment is, of necessity, somewhat superficial. In part, this reflects the practical difficulty of assessing so many different types of impacts for so many different types of control measures. It also reflects the fact that the impacts of particular control measures is generally dependent upon the specific manner in which they are implemented, which may vary widely in a county as diverse as Santa Clara County. (The impacts of streambank erosion protection measures, for example, will depend upon whether the specific method used involves putting the stream in a concrete culvert or simply planting vegetation along the bank to help hold the soil together.)

Plan Implementation

The Plan indicates that before June 1978 a local intergovernmental Coordinating agency will be established in Santa Clara County to monitor, evaluate, and direct future planning and action programs relative to surface runoff. The plan also indicates that the Regional Water Quality Control Board should be the primary regional enforcement agency.

Benefits of Preparing the Plan

The process of preparing the Surface Runoff Plan had several benefits:

- It provided for the first time a countywide examination of surface runoff control activities.

- It gave local agencies a chance to compare surface runoff activities to determine similarities and gaps.

- It identified the magnitude of funding and other efforts being devoted to surface runoff on a countywide basis. This amounts to more than $4,639,600 annually, most of which is local money.

- It provided a relatively good examination (considering the lack of rainfall) of problems created by surface runoff, and through this process it was determined that significant problems do not exist. Perhaps the large amount of money currently being spent on street sweeping, and litter clean up have paid off so that major problems have not occurred.

Multiple Benefits from Plan Implementation

Although the major concern of the "208" Program with regard to surface runoff is related to its impact on water quality, it should be noted that there are numerous other public concerns which may be benefited either directly or indirectly by efforts to mitigate surface runoff problems. These include preventing the loss of topsoil through erosion, reducing unsightly litter and debris, and minimizing flood hazards, to name just a few. Consequently, efforts to reduce surface runoff pollution may provide a number of other public benefits as well. Emphasis in the recommendations of this plan is given to actions which can serve to accomplish multiple public objectives.

THE PLAN

OBJECTIVES OF THIS PLAN

The three basic objectives of this Surface Runoff Management Plan are:

OBJECTIVE #1: To determine the nature and magnitude of surface runoff problems in Santa Clara County

OBJECTIVE #2: To develop a set of recommended actions acceptable to local agencies and to the Association of Bay Area Governments which will adequately mitigate identified surface runoff problems, taking into consideration the magnitude of the problems identified, the costs of implementing effective mitigating measures, and other societal problems and needs competing for limited public funds

OBJECTIVE #3: To initiate a process for designation of an appropriate local agency as the surface runoff management coordinating agency for Santa Clara County

IMPLEMENTATION SCHEDULE

The time schedule for the implementation of this plan has been divided into three phases extending over the next five years. The following is a summary of the major actions to be taken during each of the three phases:

Phase I: Now through June 30, 1978

1. Continue existing efforts

2. Monitor water quality

3. Evaluate effectiveness of existing efforts

4. Seek funding for pilot projects

5. Establish intergovernmental coordinating agency structure, responsibilities, and funding

6. Prepare first annual report including revised recommendation for action during Phase II - This will be prepared by the coordinating agency if established in time, otherwise by the County Planning Department in cooperation with the Santa Clara Valley Water District and the EMP-TAC.

Phase II: July 1, 1978 through June 30, 1980

1. Implement recommendations developed at end of Phase I

2. Prepare and adopt ordinances (e.g. erosion control ordinances)

3. Evaluate results of pilot projects

4. Evaluate existing programs and possible need for additional programs

5. Prepare annual reports containing information regarding current programs, monitoring and evaluation results, and recommendations for the following year

Phase III: July 1, 1980 through June 30, 1982

1. Implement recommendations developed during Phase II

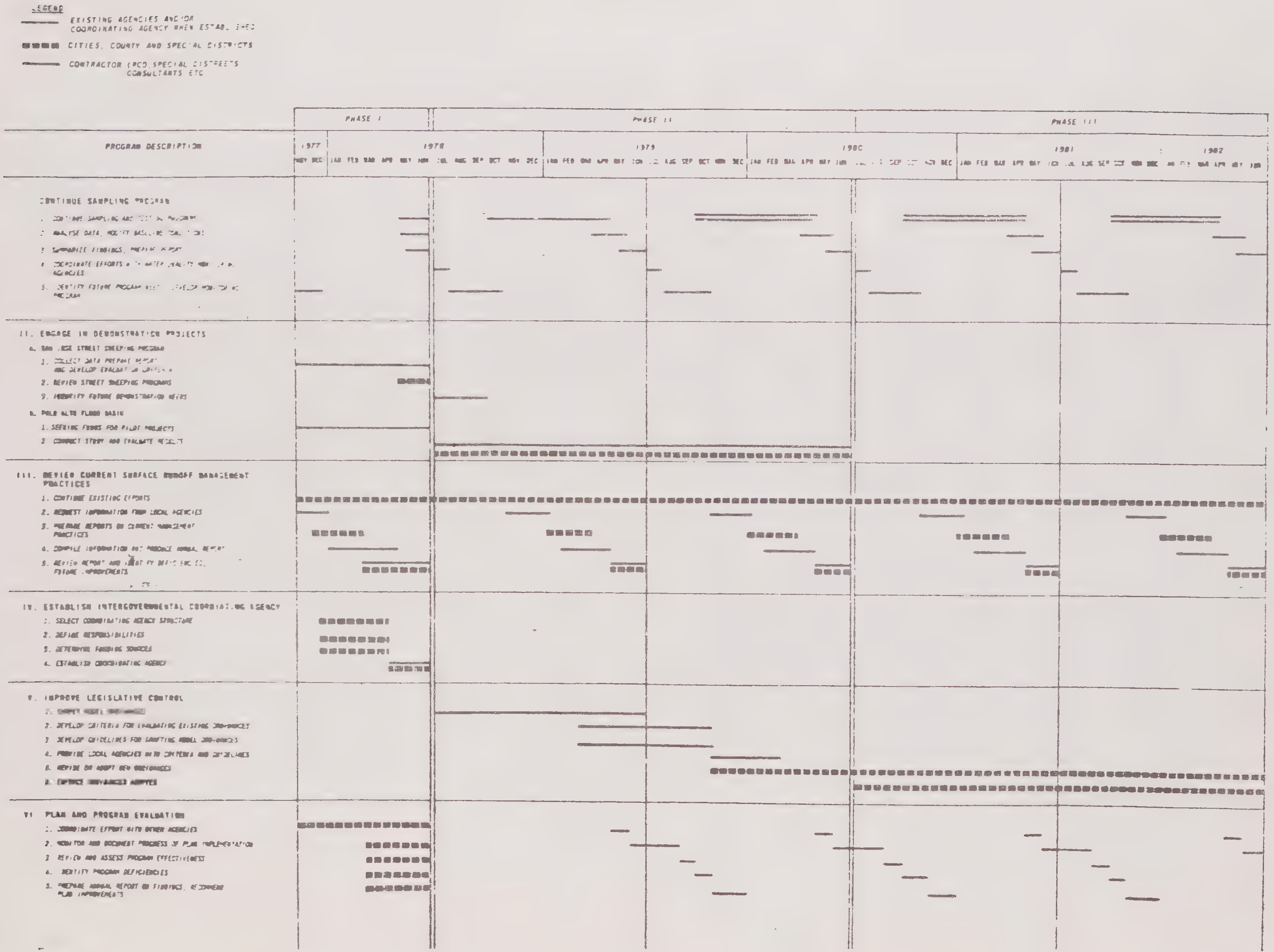
2. Prepare annual reports containing information regarding current programs, monitoring and evaluation results, and recommendations for the following year

3. Enforce ordinances enacted during Phase II

SURFACE RUNOFF MANAGEMENT PLAN

IMPLEMENTATION SCHEDULE

SANTA CLARA COUNTY



OBJECTIVE #1: To determine the nature and magnitude of surface runoff problems in Santa Clara County.

ACTIONS TO EVALUATE PROBLEMS AND MONITOR EFFECTIVENESS OF EXISTING PROGRAMS

Despite efforts by local and regional agencies to develop necessary information, there are major questions that remain unanswered as to the magnitude and specific impacts of surface runoff in Santa Clara County and the remainder of the Bay Area. Similarly, there are questions remaining to be answered regarding the effectiveness of various measures to mitigate surface runoff associated contaminants.

It is not known, for example, how much an increased street sweeping program would reduce the amount of silt and debris washed into streams and the Bay. Nor, for that matter, is it yet known whether there is any specific damage to the Bay from the silt in surface runoff that is sufficiently serious to warrant the additional public expense that increased street sweeping would entail.

Thus, it is important that local and regional agencies continue to try to develop more precise information regarding the nature and magnitude of surface runoff pollution as well as the effectiveness of existing and potential mitigating measures to reduce surface runoff associated contaminants.

The following are recommended actions for obtaining additional information regarding surface runoff problems and the effectiveness of existing and potential mitigating measures:

MONITORING AND EVALUATION

Action Program:

Agency	Existing/Proposed Actions	Schedule	Current Annual Expenditure (Phase I)	Funding Source
Regional Water Quality Control Board	• Monitor water quality in the Bay and identify specific adverse impacts of surface runoff pollution	Phases I,II,III	*	State
Santa Clara Valley Water District	• Water quality monitoring of reservoirs, surface water and groundwater	Phases I,II,III	$337,000	Local, U.S. Geological Survey, California Department of Water Resources
Santa Clara Valley Water District	• Pilot project to determine role of Palo Alto Flood Basin in mitigating surface runoff pollution	Phase II		EPA grant (to be sought)
Local surface runoff management coordinating agency (yet to be designated)**	• Monitor local mitigation programs; prepare annual reports regarding local efforts and their efforts and their effectiveness	Phase I Phases II,III	$20,000 *	208 funds Local
Santa Clara County Health Department	• Monitor water quality in reservoirs, marginal monitoring in streams	Phases I,II,III	*	Local
San Jose Dept. of Public Works	• Street Sweeping Evaluation Project	Phase I	$80,000	EPA grant

* Cost not known
** See section on "Intergovernmental Coordination Within Santa Clara County"

Note: Local expenditures related to monitoring and evaluating Surface Runoff problems and effectiveness of existing efforts to mitigate problems total more than $417,000.

OBJECTIVE #2:	To develop a set of recommended actions acceptable to local agencies and to the Association of Bay Area Governments which will adequately mitigate identified surface runoff problems, taking into consideration the magnitude of the problems identified, the costs of implementing effective mitigating measures, and other societal problems and needs competing for limited public funds

ACTIONS TO MITIGATE EXISTING OR POTENTIAL PROBLEMS

Four different types of existing or potential surface runoff problems were identified during the preparation of this plan. Specifically, they are:

1. Silt and debris (including heavy metals)
2. Oil and grease
3. Biocides
4. Mercury

Monitoring and sampling programs have identified a generalized problem with silt and debris, but it should again be emphasized that the magnitude of most of these existing or potential problems is still largely undetermined. Despite runoff and Bay water quality monitoring efforts by local and regional agencies, all the exact impacts of these contaminants on the Bay and local streams and reservoirs are not known. Thus; except for silt and debris, it cannot be conclusively stated at this time that the contaminants listed above are causing serious surface runoff pollution problems in Santa Clara County.

In part, this inability to identify specific, serious consequences from much of the surface runoff may be a reflection of the fact that there are many actions already being taken by local agencies in Santa Clara County which may be substantially mitigating what might otherwise be serious problems. Thus, in effect, local agencies may already have many of these problems largely under control.

The following sections describe each of the four types of existing or potential problem, the sources of these problems, some potential solutions to these problems and the actions which currently are being taken or will be taken to mitigate each type of problem. Also indicated are the agencies responsible for taking action, the schedule for actions to be taken, and the costs and sources of funds for each existing or proposed action.

PROBLEM: SILT AND DEBRIS

Silt and debris are washed by surface runoff into streams and storm drains, reservoirs, and the Bay, causing aesthetic as well as water quality problems. Excessive accumulation of sediments and debris in stream channels and culverts can increase flood hazards. Sediment accumulation can also reduce the storage capacity of reservoirs, impair the functioning of percolation beds, and fill in boat channels and harbors. Silt and debris can carry with them heavy metals which may be toxic to the environment or may find their way into food chains, including those of humans.

Sources:

Erosion, particularly in undeveloped and developing areas, is the major source of silt in surface waters. This erosion has many causes, including:

- construction activity in hillside areas
- poorly constructed or maintained roads
- overgrazing
- small, intensively used animal corrals (particularly horse corrals)
- use of off-road vehicles
- improper cultivation
- streambank erosion
- erosion following wildfires

Within urban areas, silt also contains heavy metals from auto exhausts, brake linings, and other sources. Debris generally is the result of human carelessness or intentional dumping or littering.

Potential Solutions:

There are a variety of actions which can be taken to reduce sediment and debris problems. Some of the actions which may be most effective in undeveloped and developing areas include adoption of grading and erosion control ordinances, adoption of off-road vehicle regulations, and working with landowners to prepare land conservation plans for their lands. Within developed areas, street sweeping, storm drain cleaning, and litter control programs can help reduce problems from silt and debris.

SILT AND DEBRIS

Action Program:

Agency	Existing/Proposed Actions	Schedule	Current Annual Expenditure (Phase I)	Funding Source
Campbell	• Street cleaning	Phases I, II, III	$49,300	Local
	• Litter control	"	23,000	"
	• Catchbasin and storm sewer cleaning	"	20,000	"
Cupertino	• Street cleaning	Phases I, II, III	$31,200	Local
	• Litter control	"	30,000	"
	• Catchbasin cleaning	"	2,000	"
	• Enforce ordinance restricting dumping of wastes into storm sewers and catchbasins	"	*	"
	• Storm sewer cleaning	"	*	"
	• Erosion control • enforce grading ordinance • enforce drainage requirement • enforce landscaping requirement	"	*	"
Gilroy	• Street cleaning	Phases I, II, III	$18,500	Local
	• Catchbasin cleaning	"	5,000	"
Los Altos	• Street cleaning	Phases I, II, III	$22,000	Local
	• Catchbasin cleaning	"	3,000	"
	• Storm sewer cleaning	"	*	"
	• Erosion control case-by-case requirements for developer	"	*	"
Los Gatos	• Street cleaning	Phases I, II, III	$45,000	Local
	• Litter control	"	5,000	"
	• Catchbasin cleaning	"	1,700	"
	• Storm sewer cleaning	"	3,000	"
	• Erosion control ordinances	"		"
Milpitas	• Street cleaning	Phases I, II, III	$33,400	Local
	• Litter control	"	50,000	"
	• Catchbasin cleaning	"	3,300	"
	• Storm sewer cleaning	"	1,500	"
Monte Sereno	• Street cleaning	Phases I, II, III	$ 500	Local
	• Catchbasin cleaning	"	200	"
	• Storm sewer cleaning	"	200	"
Morgan Hill	• Street cleaning	Phases I, II, III	$13,000	Local
	• Litter control	"	800	"
	• Catchbasin cleaning	"	**	"

* Cost not known
** Cost Negligible

SILT AND DEBRIS (Continued)

Agency	Existing/Proposed Actions	Schedule	Current Annual Expenditure (Phase I)	Funding Source
Mountain View	• Street cleaning	Phases I,II,III	$82,900	Local
	• Catchbasin cleaning	"	14,000	"
	• Enforce ordinance prohibiting dumping into storm sewers	"		"
	• Storm sewer cleaning	"	14,000	
Palo Alto	• Street cleaning	Phases I,II,III	$147,000	Local
	• Catchbasin cleaning	"	21,500	"
	• Enforce ordinance prohibiting dumping	"	*	"
	• Storm sewer cleaning	"	*	"
	• Erosion control	"	*	"
	• Grading permits requiring planting			
	• enforce open space ordinance (i.e. 10-acre minimum in foothills)			
San Jose	• Street cleaning	Phases I,II,III	$928,000	Local
	• Street sweeping evaluation project	"	80,000	EPA grant
	• Cleaning catchbasins	"	423,000	"
	• Enforce city code prohibiting dumping	"	*	"
	• Enforce grading ordinance	"	*	"
Santa Clara	• Street cleaning	Phases I,II,III	$91,000	Local
	• Litter control	"	750	"
	• Catchbasin cleaning	"	38,000	"
	• Storm sewer cleaning	"	94,000	"
Saratoga	• Street cleaning	Phases I,II,III	$10,000	Local
	• Catchbasin cleaning	"	3,500	

* Cost not known

SILT AND DEBRIS (Continued)

Agency	Existing/Proposed Actions	Schedule	Current Annual Expenditure (Phase I)	Funding Source
Sunnyvale	• Street cleaning	Phases I,II,III	$267,500	Local
	• Catchbasin cleaning	"	20,000	"
	• Storm sewer cleaning	"	16,000	"
	• Enforce ordinance against dumping into storm sewers	"	3,000	"
	• Erosion control Grading permits required	"	5,000	"
Santa Clara County	• Enforce grading ordinance	Phases I,II,III	$91,800	Local
Santa Clara Valley Water District	• Stream and channel maintenance and erosion control	Phases I,II,III	$ 86,000	Local
	• Silt and debris control	"	106,000	"
	• Stream bank erosion protection	"	343,000	"
Resource Conservation Districts	• Continued installation best management practices	Phase I	$100,000	USDA, Soil Conservation Service
			20,000	Local
			40,000	USDA, Agricultural Stabilization
			400,000	Private
	• Land management plan development by watersheds	Phase I	100,000	USDA, Soil Conservation Service
			20,000	Local
Local surface runoff management coordinating agency (yet to be designated)	• Develop model guidelines for incorporating surface runoff concerns into EIR process	Phase II	*	Local
San Francisco Bay Regional Water Quality Control Board	• Monitoring Program and further problem evaluation	Phases I,II,III	*	State
Cal Trans	• Litter control along freeways and other State-maintained roads	Phases I,II,III	$287,000	State

Note: The total expenditures by local agencies in Santa Clara County to mitigate potential silt and debris problems is currently more than $4,214,600 per year.

PROBLEM: AUTOMOTIVE OIL AND GREASE

Oil and grease have been found in local streams and in the Bay. Floating oil can kill the phytoplankton which live in the Bay and the oceans. Phytoplankton produce over half of the earth's oxygen. In addition, the metal oxides in used oil are not biodegradable. They can enter the food chain, including food consumed by humans. These metal oxides are potential causes of cancer.

Sources:

Some of the oil and grease pollution in the Bay comes from boats which use the Bay. Some of it, however, is washed into the Bay from city streets and parking lots and from used oil which is dumped into storm drains.

Potential Solutions:

Reducing the amount of used oil which is dumped into storm drains is an important step toward mitigating oil and grease pollution in local streams and the Bay. Public education programs can be helpful in making people aware of the consequences of dumping used oil down the drain. In addition, however, establishment of oil recycling stations where used oil may be brought for recycling is needed.

Action Program:

Agency	Existing/Proposed Actions	Schedule	Current Annual Expenditure (Phase I)	Funding Source
Santa Clara County	• Oil recycling program	Phases I,II,III	**	Local
Cupertino	• Oil recycling program	Phases I,II,III	**	Local
Los Altos	• Oil recycling program	Phases I,II,III	**	Local
Santa Clara	• Oil recycling program	Phases I,II,III	$1,000	Local
San Jose	• Oil recycling program	Phases I,II,III	*	Local
Saratoga	• Oil recycling program	Phases I,II,III	**	Local
Sunnyvale	• Oil recycling program	Phases I,II,III	**	
Association of Bay Area Governments	• Public education campaign	Phases I,II,III	*	
American Assn. of University Women	• Public education campaign regarding oil recycling	Phases I,II,III	*	
Private Industry	• Oil recycling program	Phases I,II,III	*	Private

Note: More than $ 1,000 is currently being spent each year by local governments in Santa Clara County on oil recycling programs.

* Cost not known
** No cost to agency except that of providing facilities for operators

PROBLEM: BIOCIDES

Biocides, such as pesticides, herbicides, and insecticides, are potentially harmful to the environment. They can be washed into gutters and streams and, ultimately, into the Bay. No specific biocide problems related to surface runoff have yet been identified in Santa Clara County.

Sources:

Biocides used in agriculture are a potential source of surface runoff pollution. One study has concluded, however, that the volume of biocides used per acre may be greater in urban and suburban areas than in rural agricultural areas.

Potential Solutions:

One basic solution to potential biocide pollution problems is to minimize their use whenever possible. This can be accomplished through restrictions on their use, by encouraging reductions in their use, and by encouraging the use of alternative biological control methods.

Action Program:

Agency	Existing/Proposed Actions	Schedule	Current Annual Expenditure (Phase I)	Funding Source
Santa Clara County Agricultural Commissioner	• Regulate use of certain pesticides	Phases I, II, III	*	Local
Morgan Hill	• Biological control program	Phases I, II, III	*	"
Palo Alto	• Biological control program for city street trees	Phases I, II, III	7,000	"
San Jose	• Biological control program	Phases I, II, III	*	"

Note: More than $ 7,000 is currently being spent annually by local governments in Santa Clara County to control potential problems related to the use of biocides.

* Cost not known

PROBLEM: MERCURY

Mercury, a toxic metal, has been found in local streams and reservoirs, particularly in the New Almaden area. It is not water soluble and it tends to settle out into bottom sediments. Mercury enters the food chain and becomes concentrated in the flesh of fish. High concentrations have been found in fish taken from Almaden, Calero, and Guadalupe Reservoirs.

Sources:

The New Almaden area was once the site of extensive mercury mining activity. Although the mines are now closed, the tailings of waste rock taken from the mines remain. Mercury from these rocks washes out into the creeks flowing into Almaden Reservoir, Calero Reservoir, and Alamitos Creek below the reservoir.

Potential Solutions:

The long term ecological significance of the mercury problem is presently undetermined and warrants continued monitoring of mercury concentrations in both bottom sediments and surface waters. Beyond that, the most practical mitigation measure is simply to restrict fishing in streams and reservoirs where high concentrations of mercury have been found.

Action Program:

Agency	Existing/Proposed Actions	Schedule	Current Annual Expenditure (Phase I)	Funding Source
Santa Clara Valley Water District	• Prohibit fishing in reservoirs and streams where high mercury concentrations are found	Phases I, II, III	*	Local

* Cost unknown

OBJECTIVE #3:	To initiate a process for designation of an appropriate local agency as the surface runoff management coordinating agency for Santa Clara County

ACTIONS TO ACCOMPLISH INTERGOVERNMENTAL COORDINATION

Intergovernmental Coordination Within Santa Clara County

An important element of this plan is an ongoing planning process through which the plan can be periodically revised, information can be gathered and shared, and intergovernmental coordination of efforts can be accomplished. To carry out the activities related to this ongoing planning process, it is necessary that some agency or committee within Santa Clara County be designated as the official body for coordinating local efforts.

There are several major alternatives which should be considered in selecting the body to perform this intergovernmental coordination function, including:

1. An intergovernmental task force composed primarily of staff members from appropriate local agencies, such as the Technical Advisory Committee which guided the preparation of this plan,

2. An existing agency, such as the Santa Clara Valley Water District,

3. A specially-created policy committee, composed primarily of local elected officials, and

4. A specially-created joint powers agency, empowered to perform intergovernmental coordination functions related to surface runoff management in Santa Clara County.

Which of these or other alternatives would be most appropriate would depend, in part, on the specific functions the intergovernmental coordination agency is to perform. One of the first responsibilities the coordinating agency might have would involve preparation of the first annual report (which is required by law), containing information concerning current programs in Santa Clara County, monitoring and evaluation results, and recommendations for action during the following year.

Since that report must be prepared by June 30, 1978, it is important that a coordinating agency be designated or created as soon as is reasonably possible. To assist in this determination a memorandum from the Technical Advisory Committee will be sent to the

fifteen cities, the County, and other appropriate districts and agencies outlining alternative functions, structures, and funding sources for a local surface runoff management coordinating agency to be created before June 30, 1978. The cities and the County will be asked to decide on the appropriate structure. Should the coordinating agency not be established in time to prepare the first annual report, the County Planning Department will prepare the report in cooperation with the Santa Clara Water District and the EMP-TAC.

Coordination With Regional, State, and Federal Agencies

In addition to achieving coordination among local agencies, there is a need for coordination of local efforts with those of regional, state, and federal agencies as well. An important aspect of this intergovernmental coordination centers on the definition of the appropriate roles for each of these levels of government for monitoring water quality conditions and identifying problems, preparing and implementing surface runoff management plans, and monitoring compliance with adopted plans.

It is proposed that the following basic policies be adopted with regard to the relative roles of each level of government:

1. Preparation and implementation of surface runoff management plans should be primarily the responsibility of local agencies, coordinated in each county by a designated local agency (except as otherwise stated in the plan).

2. Annual reports indicating actions being taken by local agencies to mitigate existing or potential surface runoff problems should be prepared by the designated local agency in each county and should be submitted to the Association of Bay Area Governments, the Regional Water Quality Control Board, the U. S. Environmental Protection Agency, and other appropriate agencies.

3. Monitoring of water quality conditions in San Francisco Bay should remain primarily the responsibility of the Regional Water Quality Control Board (this is not meant to exclude other monitoring agencies such as the Corps of Engineer or the State Health Department); monitoring of water quality conditions within local streams and reservoirs should be the responsibility of local agencies.

4. Monitoring of local agency compliance with adopted local surface runoff management plans should be the responsibility of both the designated local coordinating agency(s) and the Regional Water Quality Control Board.

5. If local annual reports indicate unsatisfactory compliance with adopted local surface runoff management plans, the Regional Water Quality Control Board should enforce compliance with the plan.

6. If a serious regional water quality problem related to surface runoff is identified in the Bay that can be traced to a specific local source or area, the Regional Water Quality Control Board should require that the appropriate local agency(s) develop a plan and action program for adequately mitigating the problem.

7. The Association of Bay Area Governments (ABAG) should be designated as the regional agency responsible for coordinating the various county surface runoff management plans, and disseminating information relating to these plans.

TABLE OF CONTENTS

LIST OF FIGURES (Concluded)

LIST OF FIGURES

LIST OF TABLES (Continued)

LIST OF TABLES

TABLE OF CONTENTS (Concluded)

APPENDIX A

STUDY AREA CHARACTERISTICS

Appendix A

STUDY AREA CHARACTERISTICS

Santa Clara County lies in west-central California, at the southern end of San Francisco Bay. The county seat, San Jose, is 50 miles southeast of San Francisco and 42 miles south of Oakland. Neighboring counties include San Mateo on the northwest, Santa Cruz on the west, San Benito on the south, Merced and Stanislaus on the east, and Alameda on the northeast.

The area was first settled in the late eighteenth century. Until the mid-nineteenth century, the local economy was based on cattle raising. Hay and grain fields replaced much of the grazing in the late 1800s. The completion of the Southern Pacific Railroad to San Jose in 1864 resulted in a more diversified agricultural economy: dairy, sheep raising, and fruits, nuts, and vegetables as well as cattle. By the early twentieth century, a substantial canning industry had developed. Processing and transportation equipment for agriculture and food processing were the first manufacturing industries. World War II paved the way for a more diversified industrial base. Manufacturing and services unrelated to agriculture had replaced agriculture as the County's principal economic activity by 1950.

POPULATION

Population growth in Santa Clara County was relatively slow when the economic base was agriculture. In 1950, only 291,000 people resided in the County. Influx of new nonagricultural industry following World War II resulted in a 220 percent increase in population by 1960 (291,000 to 642,000) and 166 percent increase between 1960 and 1970 (642,000 to 1,065,000). Annual growth rates in this period were 8 to 10 percent. These rates have declined steadily since the mid-1960s and now are about 2 to 3 percent. The population stands at approximately 1.2 million. Current forecasts put population in the year 2000 at 1.75 million, an increase of nearly 50 percent (see Table A-1).

Much of this growth has been in the northwest portion of the county at the expense of agricultural land. Between 1960 and 1965, more than 18,000 acres of orchards and 8,000 acres of field crops became residential, commercial, and industrial land.

While much of the county south of San Jose remains agricultural, pressures for further urban/suburban development will be strong. The growth rate for this area is forecast to be higher than the county as a whole.

TABLE A-1

SANTA CLARA COUNTY POPULATION PROJECTIONS

Year	Population
1975	1,183,500
1980	1,307,500
1985	1,433,000
1990	1,570,200
1995	1,667,900
2000	1,752,100

Source: Santa Clara County Planning Department.

CLIMATE

The climatic regime of Santa Clara County is one of moderate temperatures and light-to-moderate precipitation. Extreme temperature readings range from around 10 to well above 100 degrees Fahrenheit; average lows in winter are in the middle 30s. Temperatures of 32 degrees Fahrenheit, or lower, are experienced in most years over much of the area. However, the growing season ranges from 200 to 300 days in length. As a result of the mild temperatures, the heating degree-day values range from 2,500 to 4,500 units. Precipitation averages only 16 inches in part of Santa Clara Valley, with over 40 inches over the mountains to the west (see Figure A-1).

The moderating influence of the Pacific Ocean, to the west, is felt in the relatively uniform temperature readings that are characteristic of the northern Santa Clara Valley. Only infrequently do offshore circulation patterns permit truly continental temperature regimes to become established, and these occasions are usually of only 2 to 3 days duration.

TOPOGRAPHY

Santa Clara County consists of the Santa Clara Valley, extending through the central part of the county, and rolling hills and mountainous uplands, on both sides of the valley. Elevations range from sea level to 4,732 feet.

The county is roughly trapezoidal in shape and contains an area of 846,426 acres (1,320 square miles). Approximately one-third of the total county acreage (about 280,000 acres) is relatively flat with few topographic

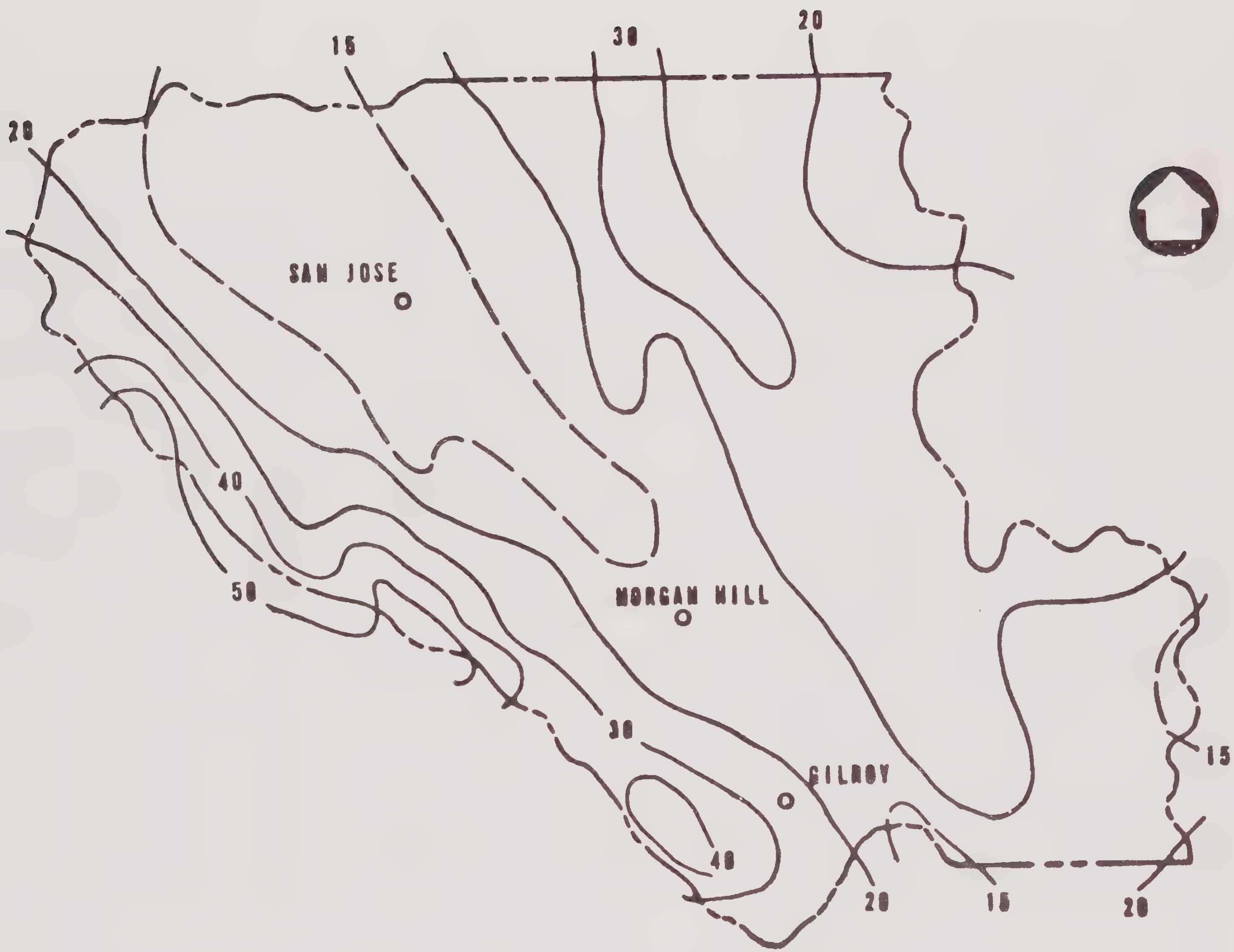


Figure A-1. AVERAGE ANNUAL PRECIPITATION, SANTA CLARA COUNTY [A-1].

barriers. The remainder is rough terrain--The Diablo Range and the Santa Cruz Mountains along the eastern and western boundaries of the county, respectively. The plain in the center of the county, starting from San Francisco Bay in the north where it is approximately 15 miles wide, extends southeasterly 25 miles to Coyote Narrows where the eastern and western mountain ranges converge. The plain widens again for another 22 miles southward of the Coyote Narrows to the San Benito County boundary where it reaches an elevation of 400 feet and is approximately 10 miles wide. Thus, the plain is in the shape of an hourglass, divided into a North Valley and a South Valley.

The cool temperature and moderate-to-strong west and northwest wind that dominate the offshore waters during the summer move into the San Francisco Bay Area at low elevations. The effect of this marine air intrusion is most pronounced in the Santa Clara Valley during the late afternoon and evening. Higher elevations are often above the layer of marine air, and its influence is diminished.

GEOLOGY AND SOILS

Geology

The oldest rocks found within the limits of Santa Clara County are included in the Franciscan-Knoxville group of Upper Jurassic age. These rocks form the largest single geologic unit in the area. Overlying the Jurassic rocks locally, are marine sedimentary rocks of Cretaceous age. Bordering the San Andreas fault, and in isolated patches in the Diablo Range, Miocene beds occur. Along the margins of Santa Clara Valley, Pliocene strata are exposed, and the valley floor itself is composed of an accumulation of Quaternary clay, sand, and gravel. Tertiary volcanic rocks are scarce, and in the few isolated localities where found, they occur only as small local bodies.

The structure of Santa Clara County is complex. It is controlled by faulting, the trend of which is predominantly in a northwesterly direction, characteristic of the general structural trend of California. In many places, folding and crumpling of the sediments are associated with faulting. The most notable faults in the area, and indeed, the major features of the Central Coast Ranges, are the San Andreas, Hayward, and Calaveras. The San Andreas fault, together with one of its prominent branches, the Sargent fault, subparallels the western boundary of Santa Clara County and separates Miocene strata from Upper Jurassic rocks. The Calaveras and Hayward faults are nearly parallel to each other on the western side of the Diablo Range. These three major fault systems--San Andreas, Hayward, and Calaveras--are predominantly of the strike-slip type with probable large right lateral displacements (east blocks moved relatively south). Two important faults branching off the Calaveras are the Madrone Springs fault and the Silver Creek fault.

Numerous northwest-trending folds in the tertiary beds have been mapped. Folding within areas of Upper Jurassic rocks, however, is not so well known because persistent axes cannot be traced with certainty.

Soils

By reviewing soil characteristics and qualities, the soils of a certain land area may be identified for their best used, limitations, and management. Each kind of soil has definite characteristics and qualities. Knowledge of these properties permits the grouping of soils according to their limitations or suitabilities for different uses.

There are five general soil groups in Santa Clara County, each made up of one or more minor areas of soil that may or may not be like the dominant soils within the area. Each area is called a soil association, and is named for the major soil series it contains. Soil associations differ from one another by having contrasting soil properties, or differing in potentialities. General soil information for Santa Clara County is shown in Table A-2.

TABLE A-2

GENERAL SOIL INFORMATION, SANTA CLARA COUNTY

Group	Description	General location
I	Areas dominated by fine textured soils and land types influenced by tidal water	Tidal flats and tidal marshland along southern San Francisco Bay
II	Areas dominated by very deep, level, somewhat poor to poorly drained soils	Alluvial plains southeast of Gilroy, from San Jose north-westerly to tidal marsh areas, and small areas at other locations on floor of Santa Clara Valley
III	Areas dominated by moderately well to somewhat excessively drained, medium to fine textured soils of the alluvial plains and fans	Nearly level to moderately sloping alluvial plains and fans of the floor and edges of Santa Clara Valley
IV	Areas dominated by soils with slow to very slowly permeable soils of the older alluvial fans and terraces	Gently to strongly sloping old fans and moderately steep terraces along edges of Santa Clara Valley
V	Areas dominated by upland soils developed on sedimentary, basic igneous and serpentine rock	Moderately steep to very steep uplands on both sides of Santa Clara Valley

HYDROLOGY

The three major groundwater basins, which are interconnected and occupy nearly 30 percent of the total county area, are the Santa Clara Valley, Coyote, and Llagas. Groundwater supplies nearly 60 percent of the total water used in the Santa Clara Valley basin and nearly all of that used in the Coyote and Llagas basins.

Groundwater in Santa Clara County occurs in both the confined and unconfined condition. The unconfined condition exists along the peripheral areas of the Santa Clara Valley basin, throughout the Coyote basin, and in the area north of Rucker Avenue in the Llagas basin. In the confined areas, groundwater is generally pumped from the deeper aquifers (more than 150 feet deep). This water is generally of a better quality than that found in the overlying shallow aquifers (less than 150 feet deep).

The groundwater pumped from most of the existing wells in the county generally is of good quality. However, areas near the bay experience salt water intrusion, and the migration of saline water up tidal channels causes contamination.

Surface water hydrology is affected by storm and precipitation patterns as well as topography and other watershed characteristics. Since the crest of the Santa Cruz Ridge forms most of the southwest boundary of the county, and the divide of the Diablo Range forms a major portion of the eastern county boundary, most of the county's surface water runoff flows toward the Santa Clara Valley and subsequently to San Francisco Bay.

There are two notable exceptions to this pattern. About 240 square miles in the northeast section of the county drains northward into Alameda County and thence to the bay. A South County drainage area of about 400 square miles feeds southward to the Pajaro River along the southern county boundary and thence to Monterey Bay.

The Coyote Creek drainage system is the most extensive in the county, including the balance of the eastern mountains and foothills and the eastern part of the valley in North County. The creek flows northward from Coyote and Anderson reservoirs toward the bay.

The Guadalupe River drains a large part of south San Jose and the hills around Calero, Almaden, and Guadalupe reservoirs. Los Gatos Creek, rising above Lake Elsman, supports two lower reservoirs, Lexington and Vasona, and joins the Guadalupe in central San Jose.

A number of other drainageways rise in the Santa Cruz Mountains and flow northward toward the south bay. These include San Tomas, Saratoga, Calabazas, Stevens, Permanente, Adobe, Matadero, Los Trancos, and San Francisquito creeks.

The storage reservoirs, which are operated by the Santa Clara Valley Water District principally for domestic and agricultural use and groundwater recharge, serve to reduce the peak flowrates for flood and control purposes.

APPENDIX B

SURFACE RUNOFF WATER QUALITY

APPENDIX B

SURFACE RUNOFF WATER QUALITY

SUMMARY OF PAST STUDIES

Past studies on topics related to surface runoff are summarized in Table B-1. These studies include compilations of basic data such as precipitation, streamflow and soil information. Also included are studies on particular problems related to flood control, erosion control, sediment control, water supply, and drainage. Studies on plan for construction of facilities such as storm drainage ways, dams, and related environmental impact reports are also included.

EXISTING SURFACE RUNOFF DATA

Available surface water quality and quantity data were collected from the following agencies:

Santa Clara Valley Water District
U.S.G.S.
Department of Water Resources, State of California
Department of Transportation, State of California
Corps of Engineers
EPA
Water Quality Control Board
Bureau of Reclamation

The location of the sampling operations and the constituents analyzed are summarized in Table B-2. Water quality data for the reservoirs in Santa Clara County are listed in Table B-3.

STORMWATER RUNOFF SAMPLING PROGRAM

To help identify surface runoff water quality problems, a runoff water quality data collection program was developed. With assistance provided by the SCVWD and the Technical Advisory Committee, the objectives of the collection of additional surface runoff quality data were identified as:

- Data collection should cover as many types of land use as possible
- Sampling locations should be distributed geographically over the entire county
- Data generated should satisfy ABAG's modeling needs
- Data collected should be coordinated with local interests

TABLE B-1. SUMMARY OF PAST STUDIES
SANTA CLARA COUNTY

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
BASIC DATA							
SCVWD	Annual Survey Report on Groundwater Conditions	Issued annually	District area (valley only)	Current conditions of groundwater basins	Water quality, water supply, land subsidence	Varies annually	--
SCVWD	District Hydrologic Data Management	Aug 1976	District area	Outline of management and processing methods for hydrologic data	Data retrieval	--	--
Averett, R.C., et al. (USGS)	Water Chemistry of the Santa Clara Valley, California	1971	District area	(1) Concentrations of 17 minor elements in various water supply courses; (2) determination if such elements can be used as tracers of groundwater movement	Water quality	Wide variation in concentrations; more detailed study needed to understand such variations	--
Lindsay, W.C. (USDA, SCS)	Soil Survey of Eastern Santa Clara Area, California	1974	Eastern half of county	Basic soil data for land use planning	Soil	--	--
USDA, SCS	Soils of Santa Clara County	1968	Entire county	Basic soil data for land use planning	Soil	--	--
Carrol E. Bradberry & Associates	Hydrologic Atlas, Santa Clara County	1964	Entire county	Partial analysis of rainfall and runoff data for planning purposes	Precipitation, runoff, rainfall intensity-duration curves, flood frequency curves	--	May be outdated
Carrol E. Bradberry & Associates	Summary Report. Hydrologic Data Program. Phase III - Stream Flow Snythesis. Santa Clara County	1964	--	Synthesis of stream flow in areas having inadequate data for hydrologic data for hydraulic design	Rainfall, runoff	Revision of hydrologic atlas	--
Jones, F.E. (CSDPH)	Evaluation of Stream Sampling for Bacteriological Content. Uvas Creek	1960	Uvas Creek watershed	Bacteriological analyses	Water quality	(1) Increased coliform content following early rains; (2) subsequent rainfall lowered coliform density because of dilution; (3) average coliform counts greater than that acceptable for domestic purposes	Runoff from ranch operations a major contributor to high coliform densities

TABLE B-1. (Continued)

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
FLOOD CONTROL STUDIES AND PLANS							
Saah, A.D. and E. Watson	...Use of the Corps of Engineers Flood Hydrograph Package NEC-1 as a Predictive Model	1976	Ross Creek (case study)	Application of computer program to model effects of urbanization on flooding	Flood control	In case study (Ross Creek) derived runoff frequency curve matches recorded data	--
SCVWD	Engineer's Report and Draft EIR on Proposed Flood Control Measures on the Palo Alto Flood Basin... (Amended Report)	1976	See title	See title	Flood control	(1) Most environmentally and economically desirable project is widening and raising existing levees; (2) adverse impacts: construction activity (noise, dust), aesthetics	--
Corps of Engineers, San Francisco District	Flood Plain Information, Llagas Creek Unit 1	1975	See title	Presentation of flood potential and hazards for land use planning	Flood control	(1) Factors affecting flooding: obstructions, forecasting, evacuation plans, etc.; (2) description of past floods; (3) description of future floods	--
Corps of Engineers San Francisco District	Working Paper, Environmental Evaluation of Alternatives for Flood Damage Mitigation for Pajaro River Basin Near Gilroy, California...	1975	See title	Description of environmental setting and impacts of alternatives (prelude to EIR)	Flood control	Preliminary evaluation of 10 alternative concepts; only one found economically justified; next step in planning process is further refinement of plans along this concept	--
Corps of Engineers	Review Report for Flood Control and Allied Purposes, Pajaro River Basin, California	1975	Uvas and Llagas watersheds	Screening study of alternatives to obtain approval for detailed study of alternatives	Flood control	Only economically feasible alternative is levees along one side of Uvas-Carnadero Creek	--
SCVWD	Engineer's Report on Proposed Flood Control Measures on Berryessa Creek...	1975	Berryessa Creek (lower Penitencia Creek to Calaveras Boulevard	Project report for flood control facility	Flood control	Project necessary because (1) reduces flood hazard in most economical way; (2) conforms to City of Milpitas Master Plan; (3) lack of formal opposition	--

TABLE B-1. (Continued)

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
Mark Thomas & Co.	Revised Master Plan, City of Cupertino Storm Drainage System	1975	Cupertino	(1) Review existing plan; (2) estimate costs to complete system; (3) analyze fee structure	Flood control/ drainage	Preliminary design: 12 to 15-inch minimum pipe size; parallel pipe to upgrade existing system	--
SCVWD and south SCCWCD	Flood Damage: Pajaro River Basin...	1975	Uvas-Carnadero Creek	(1) Ascertain flood damages; (2) evaluation of benefits of proposed Hayes Valley Reservoir and/or existing reservoirs	Flood control	Hayes Valley Reservoir Project would result in $3 million/yr benefits (damage reduction, water supply, recreation); $2.73 million/yr construction cost; benefits/cost = 1.1	--
Diridon Research Corp.	Survey of District Attitudes in the SCVWD	1974	East zone	Opinion survey, Silver Creek area flood problems	Flood control	Marginally favorable feelings toward flood control projects, except for voting on bonds	--
Trice, A.H.	Report on Flood Damages on Guadalupe River, Coyote Creek, and adjacent streams	1974	See title (selected reaches)	Assessment of potential flood damages	Flood control	Total damages from standard project flood estimated at $103 million in January 1974	--
Tudor Engineering	A Report to the SCCFC &WD on the Baylands Salt Water Flood Control Planning Study	1973	Shore of Bay to Bayshore Freeway, Rte. 237 and Rte. 17 (approximate boundaries)	Develop information to determine if district should have salt water flood control responsibilities	Flood control	Costs for various alternatives estimated; no recommendations made	--
SCVWD	Report on Conditions and Status of Saratoga Creek Within the Santa Clara City limits	1973	See title	See title	Flood control erosion	Channel is inadequate to carry design flood in lower two-thirds. District and city should repair local erosion problems; remove weeds that are fire hazards; and study long range solutions.	--
Corps of Engineers, San Francisco District	Flood Plain Information Uvas-Carnadero Creek, Pajaro River to Uvas Reservoir	1973	See title	Presentation of flood potential and hazards for land use planning	Flood control	(1) Factors affecting flooding: obstructions, forecasting, evacuation plans, etc.; (2) description of past floods; (3) description of future floods: flow and extent of flooding	--

TABLE B-1. (Continued)

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
Corps of Engineers San Francisco District	Flood Plain Information Fisher Creek, Pajaro River to Uvas Reservoir	1973	See title	Presentation of flood potential and hazards for land use planning	Flood control	(1) Factors affecting flooding: obstructions, forecasting, evacuation plans, etc.; (2) description of past floods; (3) description of future floods: flow and extent of flooding	--
Corps of Engineers San Francisco District	Flood Plain Information Alamitos Creek, Pajaro River to Uvas Reservoir	1973	See title	See above (Fisher Creek)	Flood control	See above (Fisher Creek)	--
Corps of Engineers San Francisco District	Flood Plain Information Guadalupe River, Pajaro River to Uvas Reservoir	1972	See title	See above (Fisher Creek)	Flood control	See above (Fisher Creek)	--
City of Santa Clara	A Comprehensive Report Relative to Storm Drainage Protection for the Area North of the Bayshore Freeway...	1972	See title	Feasible plan for flood protection (design criteria)	Flood control	(1) Encroachment of tidal waters and lack of drainage system are primary problems; (2) series of dikes is recommended solution	--
Santa Clara County Planning Department	Flood Control in south county (South Santa Clara County Plan Program)	1972	South county	See findings	Flood control	Coordination among local agencies needed	--
Santa Clara Department of Public Works	Drainage in south county	1972	Unincorporated area in valley floor	Summary of storm drainage situation vis-a-vis land development of highway construction	Flood control/ drainage	County should assume responsibility for storm sewers in areas less than 640 acres	--
DMJM	Final Report on Flood Control and Water Quality for the Proposed Park of the Guadalupe	1971	See title	(1) Define flood control facilities for 100-yr storm compatible with proposed park; (2) review water quality problems	Flood control, water quality	Design criteria for flood control channel and structures; water quality and levels can be maintained	--
Corps of Engineers San Francisco District	Flood Plain Information Coyote Creek, San Francisco Bay to Anderson Reservoir	1970	See title	Presentation of flood potential and hazards for land use planning	Flood control	(1) Factors affecting flooding: obstructions, forecasting, evacuation plans, etc.; (2) description of past floods; (3) description of future floods: flow and extent of flooding	--

TABLE B-1. (Continued)

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
Brown & Caldwell	Wastewater Collection and Storm Drainage	1965	Palo Alto, portion of Los Altos Hills	Study and develop program for storm drainage	Flood control/ drainage	Design criteria and cost estimate for various projects	--
Loma Prieta Soil Conservation District et al.	Watershed Work Plan, Lower Llagas Creek Watershed and Watershed Work Plan, Upper Llagas Creek Watershed	1967	See title	Plans for improvements to Llagas Creek	Flood control	Benefit/cost ratio = 1.8 for lower, 2.0 for upper	--
WATER SUPPLY STUDIES AND PLANS							
Graveto, V.N., et al. (SCVFCWD)	South Santa Clara County Water Planning Study. Volume I	1972	South Santa Clara County	Planning of water resources for potential growth of study area	Water supply, water quality	Summary of water demands, supplies, and quality; preliminary analysis of conceptual alternatives for water resources management	--
SCVWD	Master Plan. Expansion of In-County Water Distribution System	1975	Entire county	(1) Assess future water needs (sources of supply, population growth); (2) evaluate alternatives for meeting needs	Water supply	San Felipe Project is most viable alternative; additional distribution facilities also recommended	--
Consoer-Bechtel	Water Reclamation and Reuse... Phase I Report	1973	District area	(1) Identify markets for reclaimed water; (2) characterize wastewaters that could be reused; (3) evaluate alternatives for reuse	Water supply	(1) No clear economic or technical choice between reclamation and San Felipe Project; (2) best markets for reclaimed water are recharge in north county and irrigation in south county	--

TABLE B-1. (Continued)

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
WATER QUALITY STUDIES							
Iwamura, T.I., et al.	Effects of Urbanization on Groundwater Conditions... (Draft)	1973	Permanente Creek,	Determine effects of urbanization on groundwater quality and quantity	Water quality, water supply	Land use changes greatly affect surface and groundater conditions	Magdalena Creek runoff has increased over time due to urbanization; not so for Permanente Creek which is not urbanized (used double mass curve technique)
SWRCB	Tentative Water Quality Control Plan Report, San Francisco Bay Region...	1974	Region 2	Water quality control plan ("Basic Plan")	Water quality	Discussion of problems of and alternative solutions to non-point source waste loads	--
GEOLOGY/ SOILS STUDIES							
Rogers, T.H. California Division of Mines and Geology	Environmental Geologic Analysis of the Northern Santa Cruz Mountain Range...	1973	Santa Cruz Mountains, Montebello Ridge	Identification and mapping of geologic features and process which could present hazards to development	Basic geology, slope stability, flood hazards, erosion	(1) Geologic structure controlled by San Andreas fault zone; (2) active fault zone but no creep discovered; (3) relatively high and low slope/ geologic (seismic) stability in area; (4) negligible flooding hazards--all streams can handle 100 or 200 year event except Adobe Creek	--
Williams, J.W. et al. California Division of Mines and Geology	Environmental Geologic Analysis of the South County Study Area. Santa Clara County, California	1973	Southern Santa Clara County	Identification and mapping of geologic features and process which could present hazards to development	Basic geology, slope stability, flood hazards, erosion	(1) Area susceptible to earthquake damage; (2) mineral resources include sand, gravel, mercury; (3) geologic (slope) stability varies; (4) much of area subject to flooding from 100-year flood with or without urbanization	--

TABLE B-1. (Continued)

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
OTHER STUDIES AND PLANS							
Ritter, J.R. et al. USGS	Sedimentation of Williams Reservoir, Santa Clara County, California	1972	Williams reservoir drainage area	(1) Determine volume of sediment in reservoir deposited between 1913-1961; (2) determine effect of 1961 fire on rate of sediment deposit	Sediment	(1) 30 to 60% of current volume of sediment (since 1913) attributable to increased erosion from 1961 fire; (2) much of this sediment probably flushed out of reservoirs	--
Santa Clara County Planning Policy Committee	A Policy Plan for the Baylands of Santa Clara County	1972	San Francisco Bay shoreline, Highways 101, 237, and 17 (approximate boundaries)	Develop plan for baylands to solve various problems	Land use (including water quality, land use, and flood control)	Strengthen inboard dikes; stop sewage discharge; control of development	--
Santa Clara County Planning Department	Urban Development/ Open Space Plan for Santa Clara County, 1973-1978	1973	Entire county	Background information and policy recommendations for countywide open space/development issues	Land use	(1) Reform of water agency structure to allow for multipurpose functions; (2) flood control facilities and aqueduct lines should include recreational facilities; (3) maintain streams in natural state wherever possible	--
Santa Clara County Land Development Engineering and Surveying	Storm Drainage Master Plan of Southern Portion of Santa Clara County	1977	Santa Clara County south of Coyote	Planning of drainage facilities	Drainage	Size and location of future drainage facilities	--
ENVIRONMENTAL IMPACT REPORTS							
Resources and Ecology Projects	Environmental Impact Study, Calero Reservoir Project	1971	See title	EIR	Water supply	(1) Certain rocks should not be used as riprap because of heavy metal content; (2) recommends a wasp control program; (3) recommends an algae control program; (4) recommends nature trails, tree and brush plantings, bird baths; (5) sheep grazing rather than cattle; (6) reserve marsh area below dam	--

TABLE B-1. (Concluded)

Author	Title	Date	Area covered	Purpose	Subject	Major findings	Remarks
URS Research Company	EIR on the SCVWD East Flood Control Zone Project (3 volumes)	1974	East zone	EIR	Flood control	--	--
Environmental Science Associates	Working Paper. Environmental Assessment for Proposed Upper and Lower Llagas Creek Watershed Flood Control Project	1974	See title	Draft EIR	Food control	Some adverse ecological, hydrological, noise, social, and visual impacts; few beneficial impacts. No mitigation measures proposed by project sponsors (Soil Conservation Service)	--
URS Research Company	Final EIR. Proposed Lower Silver Creek Flood Control Project, Phase 1	1976	See title (Cunningham Avenue to Capitol Expressway)	EIR	Flood control	Adverse impacts from construction, traffic spoils disposal (sediment), dust, noise, removal of vegetation and wildlife habitats; various mitigation measures proposed	--
Environmental Impact Planning Corp.	Los Gatos Creek Flood Control Planning Study. Final EIR	1976	Los Gatos Creek in Town of Los Gatos	EIR	Flood control	Stimulate industrial development at the expense of agricultural land; erosion until vegetation re-established; some wildlife habitats destroyed; increased recreational opportunities	--

NOTES:

1. Sources included Metcalf & Eddy library; Water Resources Archives, University of California, Berkeley; and the Santa Clara Valley Water District Library.

2. Abbreviations: USDA - United States Department of Agriculture; SCS - Soil Conservation Service; USGS - United States Geological Survey; CSDPH - California State Department of Public Health; SCVWP - Santa Clara Valley Water District; SCVFCWD (or SCVFC&WD) - Santa Clara Valley Flood Control and Water District; DMJM - Daniel, Mann, Johnson, and Mendenhall; SWRCB - California State Water Resources Control Board; EIR - Environmental Impact Report.

TABLE B-2. SURFACE WATER QUALITY DATA

SANTA CLARA COUNTY

Source	Date	Location	Constituent analyzed	Remarks
Hydrological Engineering Center (HEC) U.S. Corps of Engineers, USGS	Sep 1972 to Mar 1974	Ross Creek	DO, BOD, COD, SS, VS, TDS, PN, H-metals, oil and grease, pesticides, pH, detergents, major ions, organic carbons, temp. floatables, coliforms	Continuous samples for selected storms.
USGS	1972-1974	Ross Creek below Jarvis Road at San Jose	All physical, chemical, biological data except sediments	Continuous for flow, monthly for quality
	Mar 18-22, 1975	Upper Penitentia Creek at San Jose	Standard minerals and minor elements	--
	1973	Calabazas Creek at Rainbow Drive	All physical, chemical, coliform, sediment concentration, particle size	--
	1973-	Calabazas Creek tributary 4 at Mt. Eden Road	Particle size	--
	1972	Prospect Creek at Saratoga golf course	Sediment concentration, particle size	--
	Jun 9, 1971-Mar 22, 1975	Saratoga Creek at Saratoga	Standard minerals	--
	Mar 18-22, 1975	Saratoga Creek at Saratoga	Minor elements	--
	1972	Calabazas at Via Regina near Saratoga	Particle size annual	--
	Aug 7, 1973, Apr 4, 1973-Mar 1, 1974	Calabazas Creek at Saratoga Drive	Standard minerals, minor elements, nutrients	--
	Dec 18, 1951-Apr 25, 1975	Los Gatos Creek at Los Gatos	Standard minerals	--
	May 21, 1968	Los Gatos Creek at Los Gatos	Daily and peak discharge, TDS, nitrogen, phosphorus, specific conductance, pH, turbidity, standard minerals, nutrients	--

TABLE B-2. (Continued)

Source	Date	Location	Constituent analyzed	Remarks
USGS	1961 and 1964	Uvas Creek above Uvas Reservoir near Morgan Hill	Daily and peak discharge, sediment, particle size	--
	1970-1971	Bodfish Creek near Gilroy	Daily and peak discharge, particle size (suspended only)	--
	1953-1966	Uvas Creek near Morgan Hill	TDS and common ions--annually; TDS, chloride, common ions, hardness, minor elements, specific conductance, pH--monthly	--
	1960 and 1964	Coyote Creek near Gilroy	Daily and peak discharge, sediment concentration, particle size, temperature	--
	1971	Llagas Creek above Chesbro Reservoir near Morgan Hill	Daily and peak discharge, sediment and particle size	--
	Jan 16, 1952-Apr 25, 1975	Coyote Creek near Madrone	Discharge	--
	May 2, 1968	Coyote Creek near Madrone	Standard minerals, nutrients	--
	1953-1966	Coyote Creek near Madrone	Quality, daily and peak discharge, TDS, chloride, nitrogen, common ions, hardness, minor elements, specific conductance, pH	--
	1961 and 1970-1971	Cedar Creek near Bell Station	Daily and peak discharge, particle size (suspended only)	--
Santa Clara Valley Water District	1974-1976	Lake Cunningham	BOD, nutrients, coliforms	Grab samples during wet weather
	Apr 14, 1973-Mar 1, 1974	Los Gatos Creek at Lark Avenue	Standard minerals, minor elements, nutrients	Continuous sampling
	Jun 19, 1975-Oct 23, 1975	Guadalupe River at Park Avenue in San Jose	Standard minerals, nutrients	
	1972-1976	Calabazas Creek and Prospect Creek	Sediment discharge, hardness, BOD, COD, carbon dioxide, pesticides, heavy metal	--
	1975-1976	All reservoirs	Standard minerals, nutrients, coliform, COD, MBAS, TOC, minor elements	Sampling frequency varies from monthly to bimonthly

TABLE B-2. (Continued)

Source	Date	Location	Constituent analyzed	Remarks
Santa Clara Valley Water District	Oct 9, 1969	Stevens Creek Reservoir vault	Standard minerals, nutrients	--
	--	Stevens Creek Reservoir at dam	Standard minerals, nutrients	--
	--	Lexington Reservoir vault	Standard minerals, nutrients	--
	Nov 18, 1969	Almaden Reservoir at dam	Standard minerals, nutrients	--
	1974	Anderson Reservoir	Physical, chemical, and biological	--
	Oct 1974-Sep 1975	Anderson Reservoir	Limnological	--
	1974	Anderson North - Las Animas	Standard minerals, nutrients	--
	Apr 6, 1973-May 22, 1974	Fisher Creek at Monterey Highway at Coyote	Standard minerals, minor elements, nutrients	--
	--	Llagas Creek below spillway	BOD, COD, coliforms, nutrients	--
EPA, URS	1971-1972	San Jose	BOD, COD, heavy metals, nutrients, total and fecal coliforms	Street sweeping study
California Department of Transportation	Apr 4, 1973-Mar 20, 1974	Guadalupe River at Branham Street	Standard minerals, miscellaneous minor elements, nutrients	--
	Dec 14, 1973-Feb 28, 1974	Canoas Creek at Hillsdale Road, San Jose	Standard minerals, miscellaneous minor elements, nutrients	--
	Dec 14, 1973-Feb 28, 1974	Canoas Creek at Blossom Hill Road	Standard minerals, minor elements, nutrients	--
	Apr 4, 1973-Mar 1, 1974	Wildcat Creek at SPRR at San Thomas	Standard minerals, minor elements, nutrients	--
	Apr 4, 1973	Guadalupe Creek at Santa Clara Street	Standard minerals, minor elements, nutrients	--

TABLE B-2. (Concluded)

Source	Date	Location	Constituents analyzed	Remarks
California Department of Transportation	Mar 13, 1973	Guadalupe River at Willow Street	Standard minerals, minor elements, nutrients	--
	Apr 4, 1973-Mar 1, 1974	Saratoga Creek at Cox Avenue	Standard minerals, minor elements, nutrients, and miscellaneous	--
	Apr 6, 1973 and Jul 19, 1973	Coyote Creek above Fisher Creek near Coyote	Standard minerals	
	Apr 6, 1973-Feb 26, 1974	Coyote Creek above Fisher Creek near Coyote	Minor elements, nutrients	--
	Dec 5, 1973-Feb 27, 1974	Coyote Creek at Riverside golf course	Standard minerals, minor elements, nutrients	--
Department of Water Resources	--	Guadalupe Slough at Moffett Field landing	Standard minerals, nutrients	--
	Oct 5, 1973	Sweetwater Creek below Mine Road	Standard minerals	--
	Mar 18-22, 1975	Guadalupe Creek at Guadalupe	Standard minerals, minor elements	--
	1952	Uvas Creek near Morgan Hill	Chloride, DO, temperature specific conductance, pH	--
Water Quality Control Board	--	Coyote Creek 100 yds west of towers	Nitrogen, DO, coliforms, temperature, pH	--
	--	Guadalupe River	DO, fish kill, industrial and domestic wastes	--
	--	Coyote Creek	Industrial and canning wastes	--
	--	Coyote Creek near Sunnyvale	Standard minerals, nutrients	--
	--	Calero and Almaden reservoirs, Guadalupe River	Mercury	--
	--	Coyote Creek at Alviso Slough	DO	
San Martin County Health Department	--	--	--	Septic tank potential problems
Bureau of Reclamation	Apr 6, 1973-Jul 19, 1973	Coyote Creek at Ford Road Bridge near Edenvale	Standard minerals, minor elements, nutrients	--

TABLE B-3. RESERVOIR WATER QUALITY DATA
SANTA CLARA COUNTY

Location	DO	Temp, °C	pH	EC	Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3	TDS	TH	Turb.	SAR	CO_2	$CaCO_3$	NO_3	O-PO_4
Stevens Creek Reservoir																					
At dam																					
Maximum	11.0	26	8.4	550	94	10	29	3.2	2.7	285	42	55	1.9	500	280	95	0.8	32	240	0.45	0.57
Mean	9.1	16	8.0	435	79	9.9	26	3.0	1.9	245	29	16	0.5	376	212	17	0.7	8	180	0.11	0.07
Minimum	7.0	4	7.1	308	64	9.9	23	2.9	1.2	205	8.0	9.0	0.0	202	136	1	0.7	0	130	0.00	0.02
Vault																					
Maximum	12.0	23	8.4	550	--	--	--	--	--	--	60	30	4.8	--	339	105	--	72	310	1.09	0.57
Mean	6.1	14	8.0	437	--	--	--	--	--	--	33	19	0.6	--	225	23	--	19	199	0.10	0.06
Minimum	0.0	5	7.1	308	--	--	--	--	--	--	10	9	0.0	--	156	1	--	4	140	0.00	0.00
Lexington Reservoir																					
At dam[a]																					
Maximum	11.0	27	8.8	380	200	16	22	3.8	3.8	305	140	16	2.3	380	294	140	0.7	12	192	1.00	0.177
Mean	8.6	16	8.2	323	48	12	14	2.3	0.9	146	49	10	0.8	280	150	24	0.5	6	89	0.20	0.08
Minimum	5.0	8	7.7	241	28	7.3	9.0	1.8	0.3	106	25	0.4	0.0	224	114	1	0.3	0	12	0.00	0.00
Vault																					
Maximum	12.0	20	8.3	380	276	15	22	3.8	2.1	237	160	20	2.3	352	308	180	0.6	48	190	0.51	1.91
Mean	6.5	13	7.7	322	123	13	17	2.9	1.2	193	57	12	0.8	270	155	31	0.6	19	133	0.16	0.10
Minimum	0.0	6	7.0	260	28	11	14	1.9	0.6	156	14	0.1	0.0	110	116	0	0.5	2	100	0.01	0.00
Vasona Reservoir																					
At dam																					
Maximum	12.0	27	8.3	--	57	21	27	3.8	1.5	181	70	22	1.9	348	216	150	0.8	14	190	0.89	0.59
Mean	9.6	.7	8.1	--	50	17	24	3.4	1.0	176	32	14	0.9	338	152	45	0.7	5	155	0.19	0.07
Minimum	6.0	9	7.9	--	44	13	22	3.0	0.6	171	8	10	0.0	328	114	1	0.7	0	120	0.01	0.00
Vault																					
Maximum	11.5	25	8.9	510	--	--	--	--	--	--	85	26	4.8	440	236	175	--	20	200	0.08	--
Mean	8.2	17	8.2	381	--	--	--	--	--	--	50	15	1.1	335	169	27	--	10	164	0.05	--
Minimum	0.0	9	7.8	305	--	--	--	--	--	--	30	9.0	0.0	224	130	2	--	4	110	0.03	--
Guadalupe Reservoir																					
At dam																					
Maximum	12.0	27	8.8	440	--	--	--	--	--	--	54	17	2.5	396	280	58	--	28	--	0.39	0.12
Mean	8.8	16	8.5	316	48	9.2	18	2.4	0.8	173	14	9.1	0.6	314	144	14	0.6	6	--	0.11	0.05
Minimum	2.0	7	8.4	225	--	--	--	--	--	--	4.0	6.0	0.0	176	114	1	--	0	--	0.00	0.00
Vault																					
Maximum	13.0	25	8.5	440	--	--	--	--	--	--	54	100	1.8	436	350	1,100	--	68	850	0.40	0.34
Mean	7.4	13	7.8	321	--	--	--	--	--	--	17	16	0.5	321	149	35	--	17	239	0.14	0.06
Minimum	1.0	7	7.1	245	--	--	--	--	--	--	1.0	6.0	0.0	176	70	1	--	0	105	0.01	0.01
Almaden Reservoir																					
At dam[b]																					
Maximum	12.0	25	8.6	390	--	--	12	2.4	--	--	24	11	2.2	452	256	89	--	28	240	0.5	0.19
Mean	9.1	16	8.4	295	45	16	11	2.2	2.1	193	14	7.1	0.4	352	175	18	0.4	6	200	0.08	0.06
Minimum	6.0	3	7.7	162	--	--	9.5	2.0	--	--	1.0	0.0	0.0	220	96	1	--	0	152	0.002	0.006
Vault																					
Maximum	13.0	25	8.6	340	--	--	--	--	--	--	52	20	5.7	--	474	195	--	40	410	1.29	1.5
Mean	6.4	14	8.1	268	--	--	--	--	--	--	14	9.9	0.5	428	201	26	--	14	217	0.14	0.12
Minimum	0.0	7	6.4	195	--	--	--	--	--	--	1.0	2.0	0.0	--	114	0	--	1	100	0.005	0.01
Calero Reservoir																					
At dam																					
Maximum	15.0	25	8.7	355	65	10	17	3.8	--	--	52	16	1.9	380	206	102	--	16	--	0.47	0.16
Mean	9.4	16	8.3	325	57	6.8	16	3.1	0.6	173	14	10	0.5	347	150	38	0.6	5	130	0.14	0.05
Minimum	6.0	4	6.9	285	50	3.6	16	2.4	--	--	1.0	8.0	0.0	304	100	3	--	0	--	0.00	0.00
Vault																					
Maximum	11.0	21	8.3	360	--	--	--	--	--	--	25	20	3.5	--	330	320	--	40	198	0.88	0.60
Mean	3.8	14	7.5	323	--	--	--	--	--	--	13	12	0.5	--	159	72	--	18	158	0.20	0.08
Minimum	0.0	7	6.8	285	--	--	--	--	--	--	1.0	7.0	0.0	--	120	2	--	0	130	0.00	0.00

TABLE B-3. (Continued)

Location	DO	Temp, °C	pH	EC	Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	NO_3	TDS	TH	Turb.	SAR	CO_2	$CaCO_3$	NO_3	O-PO_4
Anderson Reservoir																					
At dam																					
Maximum	14.0	25	8.4	--	54	76	24	3.4	2.1	219	50	28	2.1	416	206	32	0.7	16	--	0.48	0.15
Mean	8.8	17	8.3	--	53	46	23	2.9	1.6	213	32	13	0.6	314	156	6	0.6	3	--	0.15	0.04
Minimum	5.0	3	8.1	--	53	17	22	2.5	1.2	207	17	10	0.0	172	132	0	0.5	0	--	0.00	0.01
Vault																					
Maximum	13.0	20	8.3	360	53	76	24	3.4	2.1	219	70	25	2.6	416	206	260	--	20	210	0.80	0.28
Mean	6.5	12	7.8	350	49	46	23	2.9	1.6	213	35	14	0.6	323	151	27	0.7	13	139	0.15	0.06
Minimum	0.0	8	7.1	340	45	17	22	2.5	1.2	207	17	7.0	0.1	220	110	1	--	4	90	0.03	0.00
North Las Animas Creek Arm																					
Maximum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mean	--	18	--	--	37	19	18	2.2	0.0	181	40	9.6	0.1	234	170	10	0.6	--	--	0.00	0.00
Minimum	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coyote Reservoir																					
At dam																					
Maximum	11.5	26	8.5	651	64	18	26	3.2	2.1	237	48	16	9.0	432	234	49	0.7	32	194	0.19	0.25
Mean	7.8	17	8.2	354	57	14	22	3.0	1.2	194	27	9.8	0.7	294	132	15	0.6	8	114	0.09	0.06
Minimum	1.8	5	7.9	255	50	9.7	19	2.9	0.3	151	7.0	8.0	0.0	288	16	1	--	0	94	0.00	0.01
Vault																					
Maximum	20.0	22	8.5	--	--	--	--	--	--	--	71	20	2.0	--	238	42	--	32	220	2.00	0.22
Mean	5.2	14	7.8	--	--	--	--	--	--	--	40	14	0.3	--	149	13	--	15	146	0.10	0.05
Minimum	0.0	6	7.3	--	--	--	--	--	--	--	9.0	7.0	0.0	--	90	2	--	4	70	0.00	0.01

Note:

Abbreviations		Units
DO	Dissolved oxygen	mg/L
Temp, °C	Degrees Celsius	°C
pH	pH (field)	--
EC	Electrical conductance	mmhos
Ca	Calcium	mg/L
Mg	Magnesium	mg/L
Na	Sodium	mg/L
K	Potassium	mg/L
CO_3	Carbonate	mg/L
HCO_3	Bicarbonate	mg/L
SO_4	Sulfate	mg/L
Cl	Chlorine	mg/L
NO_3	Unfiltered nitrate	mg/L
TDS	Total dissolved solids	mg/L
TH	Total hardness	mg/L
Turb	Turbidity	JTU
SAR	Sodium adsorption ratio	--
CO_2	Carbon dioxide	mg/L
$CaCO_3$	Alkalinity	mg/L
NO_3	Dissolved unfiltered nitrate as N	mg/L
O-PO_4	Dissolved orthophosphate	mg/L

a.

	Fe (iron)	Mn (manganese)	Hg (mercury)	SS (suspended solids)	VSS (volatile suspended solids)
Maximum	1.5	0.29	--	--	84
Mean	0.48	0.08	0.005	106	64
Minimum	0.00	0.00	--	--	32

b.

	Fe (iron)	Mn (manganese)
Maximum	0.12	--
Mean	0.11	0.0
Minimum	0.10	--

Ten sampling locations were selected throughout the county. Wherever possible, selection of each sampling location was based upon the tributary area having a single land use. The demonstration watersheds were also incorporated into the sampling program. A wide range of land use types were included in the sampling program. The land use types and their locations are shown in Figure B-1.

The basic water quality constituents analyzed as the "core parameters" were BOD_5, SS, VSS, Total-N, and Total-P (recommended by ABAG to fulfill the modeling needs). Additional parameters analyzed included pesticides, TOC, lead, zinc, fecal and total coliform, oil and grease, and mercury, depending on the sampling location. A summary of the data collection program is listed in Table B-4. A total of 313 samples were collected between November 11, 1976, and May 7, 1977, and 1,010 individual quality analyses were made. Data collected during the runoff sampling program are included at the end of this appendix. No runoff was reported at the Upper Calabazas, Upper Berryessa, San Martin Creek, or Jones Creek sampling stations.

Figure B-1. Sampling and gaging locations.

TABLE B-4. SURFACE RUNOFF QUALITY SAMPLING PROGRAM
SANTA CLARA COUNTY

Watershed	Land use	Sampling location	Sampling frequency: Storms	Sampling frequency: Grab sample	Sampling frequency: Composites	Constituent analyzed, No. of tests: Core[a]	Pesticides	TOC	Lead	Fecal and total coliforms	Oil and grease	Others
1. Calabazas-lower	Low density	SCVWD 26A	8	87	2	268	4	2	26	2	1	1
2. Calabazas-upper	Medium	SCVWD 31	-	--	-	---	-	-	--	-	-	-
3. Santa Clara	Heavy industrial	Storm drain manhole located at end of court on Walsh Avenue	3	36	3	108	0	2	9	0	2	2
4. San Jose downtown	Commercial	Storm drain manhole located at 4th and San Fernando Streets	3	38	3	104	0	2	11	0	2	2
5. Guadalupe	Mixed	USGS San Jose	3	32	2	95	3	2	4	4	0	2
6. Matadero	Light	Storm drain manhole located at Matadero Creek and Hillview Avenue	3	28	1	100	0	2	6	0	2	2
7. Berryessa-lower	Developing	SCVWD 64	7	80	1	224	1	2	12	0	0	1
8. Berryessa-upper	Grazing land	Crossing of creek and Old Piedmont Road	-	--	-	---	-	-	--	-	-	-
9. Jones Creek	Agricultural	Crossing of creek and Pacheco Highway	-	--	-	---	-	-	--	-	-	-
10. San Martin	Ranchet, low density residential	Crossing of creek	-	--	-	---	-	-	--	-	-	-
TOTAL				301	12	899	8	12	68	6	7	10

a. Core parameters to be analyzed: BOD, SS, VSS, Total-N, Total-P and mercury on selected watersheds.

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 3

PAGE NUMBER 1
MONITORING DATA

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	2240	2255	2310	2325	2340	2355	10	25	40	110
RAINFALL, INCHES:	0.04	0.04	0.02	0.01	0.01	0.01	0.07	0.07	0.07	0.03
FLOW, CFS:	9.4	10.6	17.7	54.0	76.3	68.3	72.5	59.4	51.9	130.0
FLOW, MGD:	6.07	6.84	11.4	34.8	49.2	44.1	46.8	38.3	33.5	83.9
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	<3.0	<3.0	57.2	45.9	48.2	40.7	31.3	29.7	36.2	15.3
SUSPENDED SOLIDS:	436.	356.	200.	232.	584.	428.	328.	296.	352.	344.
VOLATILE SUSPENDED SOLIDS:	146.	124.	48.	60.	160.	128.	72.	76.	88.	80.
TOTAL NITROGEN:	16.1	8.4	5.9	6.4	9.9	6.9	5.1	5.2	5.9	3.5
TOTAL PHOSPHORUS:	1.65	1.02	0.91	0.81	1.33	1.09	0.81	0.71	0.94	0.77
HEAVY METALS, MG/L										
LEAD:										
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 3

MONITORING DATA

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	11	12	COMPOSITE
GENERAL DATA			
TIME:	140	210	
RAINFALL, INCHES:	0.03	0.04	
FLOW, CFS:	165.0	185.0	
FLOW, MGD:	106.	119.	
FIELD DATA			
TEMPERATURE, DEGREES C:			
PH:			
DISSOLVED OXYGEN, MG/L:			7.3
CORE PARAMETERS, MG/L			
BIOCHEMICAL OXYGEN DEMAND:	42.9	18.2	
SUSPENDED SOLIDS:	892.	1032.	
VOLATILE SUSPENDED SOLIDS:	160.	136.	
TOTAL NITROGEN:	7.3	6.0	
TOTAL PHOSPHORUS:	1.21	1.24	
HEAVY METALS, MG/L			
LEAD:			7.3
MERCURY:			
ZINC:			
ARSENIC:			
BACTERIOLOGICAL, MPN			
TOTAL COLIFORMS:			
FECAL COLIFORMS:			
FECAL STREPTOCCI:			
OTHER CONSTITUENTS, MG/L			
CHEMICAL OXYGEN DEMAND:			
TOTAL HYDROCARBONS:			2.09
OIL AND GREASE:			7.3
ALKALINITY:			

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 4

PAGE NUMBER 1
MONITORING DATA

DATE: 2/ 8/77 THRU 2/ 8/77

SAMPLE NUMBER:	1	2	3	4	COMPOSITE
GENERAL DATA					
TIME:	445	515	545	615	
RAINFALL, INCHES:	0.02	0.02			
FLOW, CFS:	0.3	0.7	3.3	2.1	
FLOW, MGD:	0.194	0.452	2.13	1.35	
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:	2.7		9.9		
SUSPENDED SOLIDS:	8.		84.		
VOLATILE SUSPENDED SOLIDS:	8.		74.		
TOTAL NITROGEN:		1.2		7.0	
TOTAL PHOSPHORUS:		0.11		0.85	
HEAVY METALS, MG/L					
LEAD:					<0.08
MERCURY:					
ZINC:					
ARSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					<1.
OIL AND GREASE:					
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 6

MONITORING DATA

DATE: 2/28/77 THRU 2/28/77

SAMPLE NUMBER:	3	5	COMPOSITE
GENERAL DATA			
TIME:	1130	1230	
RAINFALL, INCHES:	0.02		
FLOW, CFS:	0.01	0.18	
FLOW, MGD:	0.006	0.116	
FIELD DATA			
TEMPERATURE, DEGREES C:			
PH:			
DISSOLVED OXYGEN, MG/L:			
CORE PARAMETERS, MG/L			
BIOCHEMICAL OXYGEN DEMAND:	4.0	4.4	
SUSPENDED SOLIDS:	7.5	10.5	
VOLATILE SUSPENDED SOLIDS:	3.	6.	
TOTAL NITROGEN:	1.09	1.12	
TOTAL PHOSPHORUS:	0.35	0.33	
HEAVY METALS, MG/L			
LEAD:			
MERCURY:			
ZINC:			
ARSENIC:			
BACTERIOLOGICAL, MPN			
TOTAL COLIFORMS:	2400.	2400.	
FECAL COLIFORMS:	13.	8.	
FECAL STREPTOCCI:			
OTHER CONSTITUENTS, MG/L			
CHEMICAL OXYGEN DEMAND:			
TOTAL HYDROCARBONS:			0.6
OIL AND GREASE:			
ALKALINITY:			

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 8

PAGE NUMBER 1
MONITORING DATA

DATE: 3/15/77 THRU 3/16/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1930	2030	2130	2230	2330	30	130	230	330	430
RAINFALL, INCHES:	0.11	0.07	0.04	0.05	0.09	0.11	0.11	0.08	0.01	0.01
FLOW, CFS:	191.2	169.8	127.8	114.3	120.9	133.1	98.6	67.5	35.3	29.1
FLOW, MGD:	123.	109.	82.50	73.80	78.10	85.90	63.60	43.60	22.80	18.70
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	11.	10.	9.	7.	7.	6.		5.		4.
SUSPENDED SOLIDS:	512.	770.	614.	652.	710.	500.	340.	240.	324.	95.
VOLATILE SUSPENDED SOLIDS:	68.	86.	66.	66.	70.	54.		22.		25.
TOTAL NITROGEN:	3.0	3.4	3.1	3.1	3.0	2.6		2.0		1.9
TOTAL PHOSPHORUS:	0.78	0.92	0.86	0.78	0.78	0.67		0.51		0.46
HEAVY METALS, MG/L										
LEAD:	0.28		0.16		<0.08			<0.08		
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 8

PAGE NUMBER 2
MONITORING DATA

DATE: 3/15/77 THRU 3/16/77

SAMPLE NUMBER:	11	12	13	14	COMPOSITE
GENERAL DATA					
TIME:	530	630	730	830	
RAINFALL, INCHES:	0.01				
FLOW, CFS:	24.3	18.8	14.1	11.8	
FLOW, MGD:	15.60	12.10	9.10	7.62	
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:		3.		4.	
SUSPENDED SOLIDS:	144.	146.	107.	120.	
VOLATILE SUSPENDED SOLIDS:		17.		21.	
TOTAL NITROGEN:		1.8		2.0	
TOTAL PHOSPHORUS:		0.40		0.38	
HEAVY METALS, MG/L					
LEAD:		0.08		0.08	
MERCURY:					
ZINC:					0.04
APSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					
OIL AND GREASE:					61.8
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 9

MONITORING DATA

DATE: 3/24/77 THRU 3/24/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1315	1345	1415	1445	1515	1545	1615	1645	1715	1745
RAINFALL, INCHES:		0.16		0.02						
FLOW, CFS:	1.0	7.0	6.1	4.5	4.0	3.8	2.8	2.0	1.5	1.2
FLOW, MGD:	0.646	4.52	3.94	2.90	2.58	2.45	1.80	1.29	0.969	0.775
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	4.		25.			15.			12.	
SUSPENDED SOLIDS:	24.	148.	170.	80.	53.	70.	72.	44.	26.	10.
VOLATILE SUSPENDED SOLIDS:	<1.		50.			13.			7.	
TOTAL NITROGEN:	3.93		3.75			4.31			2.03	
TOTAL PHOSPHORUS:	0.16		0.58			0.37			0.27	
HEAVY METALS, MG/L										
LEAD:	<0.10		0.92			0.36			0.22	
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 9

MONITORING DATA

DATE: 3/24/77 THRU 3/24/77

SAMPLE NUMBER:	11	12	13	14	COMPOSITE
GENERAL DATA					
TIME:	1815	1845	1915	1945	
RAINFALL, INCHES:					
FLOW, CFS:	1.0	0.8	0.8	0.7	
FLOW, MGD:	0.646	0.517	0.517	0.452	
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:		7.		6.	
SUSPENDED SOLIDS:	12.	9.	7.	7.	
VOLATILE SUSPENDED SOLIDS:		1.		1.	
TOTAL NITROGEN:		1.63		1.25	
TOTAL PHOSPHORUS:		0.24		0.22	
HEAVY METALS, MG/L					
LEAD:		0.10		0.10	0.34
MERCURY:					
ZINC:					0.06
ARSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					
OIL AND GREASE:					
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1 | PAGE NUMBER 1
STORM NUMBER 10 | MONITORING DATA

DATE: 4/30/77 THRU 5/ 1/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1915	1945	2015	2045	2115	2145	2215	2245	2315	2345
RAINFALL, INCHES:	0.01		0.01							
FLOW, CFS:	1.1	1.3	0.8	2.0	3.2	3.2	2.1	1.8	1.4	1.2
FLOW, MGD:	0.711	0.840	0.517	1.29	2.06	2.06	1.35	1.16	0.904	0.775
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:										
SUSPENDED SOLIDS:	18.	38.	70.	46.	38.	38.	47.	34.	32.	13.
VOLATILE SUSPENDED SOLIDS:	10.		54.		24.		39.		24.	
TOTAL NITROGEN:	2.2		11.5		8.6		10.2		9.1	
TOTAL PHOSPHORUS:	0.23		1.10		0.83		0.78		0.74	
HEAVY METALS, MG/L										
LEAD:	<0.10		0.40		0.40		0.35		0.30	
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 10

PAGE NUMBER 2
MONITORING DATA

DATE: 4/30/77 THRU 5/ 1/77

SAMPLE NUMBER:	11	12	13
GENERAL DATA			
TIME:	15	45	115
RAINFALL, INCHES:			0.03
FLOW, CFS:	1.0	0.9	0.8
FLOW, MGD:	0.646	0.581	0.517
FIELD DATA			
TEMPERATURE, DEGREES C:			
PH:			
DISSOLVED OXYGEN, MG/L:			
CORE PARAMETERS, MG/L			
BIOCHEMICAL OXYGEN DEMAND:			
SUSPENDED SOLIDS:	17.	16.	10.
VOLATILE SUSPENDED SOLIDS:	11.		10.
TOTAL NITROGEN:	6.1		5.4
TOTAL PHOSPHORUS:	0.64		0.51
HEAVY METALS, MG/L			
LEAD:	0.22		0.15
MERCURY:			
ZINC:			
ARSENIC:			
BACTERIOLOGICAL, MPN			
TOTAL COLIFORMS:			
FECAL COLIFORMS:			
FECAL STREPTOCOCCI:			
OTHER CONSTITUENTS, MG/L			
CHEMICAL OXYGEN DEMAND:			
TOTAL HYDROCARBONS:			
OIL AND GREASE:			
ALKALINITY:			

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 11

PAGE NUMBER 1
MONITORING DATA

DATE: 5/ 6/77 THRU 5/ 6/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1330	1400	1430	1500	1530	1600	1630	1700	1730	1800
RAINFALL, INCHES:	0.01		0.01							
FLOW, CFS:	1.0	8.3	4.7	2.8	27.7	32.1	26.3	15.3	9.0	5.8
FLOW, MGD:	0.646	5.36	3.03	1.80	17.8	20.7	16.9	9.88	5.81	3.74
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:										
SUSPENDED SOLIDS:	125.	148.	84.	59.	256.	416.	236.	125.	83.	57.
VOLATILE SUSPENDED SOLIDS:		57.		35.		124.		33.		18.
TOTAL NITROGEN:		4.5		4.2		5.9		3.4		5.1
TOTAL PHOSPHORUS:		0.58		0.49		0.86		0.42		0.33
HEAVY METALS, MG/L										
LEAD:		0.14		0.18		<0.10		<0.10		<0.10
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1 PAGE NUMBER 2
STORM NUMBER 11 MONITORING DATA

DATE: 5/ 6/77 THRU 5/ 6/77

SAMPLE NUMBER:	11	12	13	14
GENERAL DATA				
TIME:	1830	1900	1930	2000
RAINFALL, INCHES:				
FLOW, CFS:	4.2	8.7	10.2	8.0
FLOW, MGD:	2.71	5.62	6.58	5.16
FIELD DATA				
TEMPERATURE, DEGREES C:				
PH:				
DISSOLVED OXYGEN, MG/L:				
CORE PARAMETERS, MG/L				
BIOCHEMICAL OXYGEN DEMAND:				
SUSPENDED SOLIDS:	36.	48.	47.	53.
VOLATILE SUSPENDED SOLIDS:		13.		12.
TOTAL NITROGEN:		2.4		2.7
TOTAL PHOSPHORUS:		0.30		0.30
HEAVY METALS, MG/L				
LEAD:		0.10		0.10
MERCURY:				
ZINC:				
ARSENIC:				
BACTERIOLOGICAL, MPN				
TOTAL COLIFORMS:				
FECAL COLIFORMS:				
FECAL STREPTOCCI:				
OTHER CONSTITUENTS, MG/L				
CHEMICAL OXYGEN DEMAND:				
TOTAL HYDROCARBONS:				
OIL AND GREASE:				
ALKALINITY:				

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 12

PAGE NUMBER 1
MONITORING DATA

DATE: 5/ 7/77 THRU 5/ 7/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1730	1800	1830	1900	1930	2000	2030	2100	2130	2200
RAINFALL, INCHES:			0.01		0.01					
FLOW, CFS:	21.7	40.5	32.1	28.4	30.6	23.6	21.1	20.5	15.1	12.3
FLOW, MGD:	14.00	26.10	20.70	18.30	19.70	15.20	13.60	13.20	9.75	7.94
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:										
SUSPENDED SOLIDS:	313.	211.	114.	133.	271.	286.	268.	184.	179.	168.
VOLATILE SUSPENDED SOLIDS:	56.			29.			46.			26.
TOTAL NITROGEN:	3.7			2.6			2.8			3.0
TOTAL PHOSPHORUS:	0.54			0.38			0.52			0.43
HEAVY METALS, MG/L										
LEAD:	0.10			<0.10			0.12			0.14
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
CALABAZAS-LOWER

STATION NUMBER 1
STORM NUMBER 12

PAGE NUMBER 2
MONITORING DATA

DATE: 5/ 7/77 THRU 5/ 7/77

SAMPLE NUMBER:	11	12	13	14
GENERAL DATA				
TIME:	2230	2300	2330	2400
RAINFALL, INCHES:		0.01		
FLOW, CFS:	12.7	10.6	8.3	7.6
FLOW, MGD:	8.20	6.84	5.36	4.91
FIELD DATA				
TEMPERATURE, DEGREES C:				
PH:				
DISSOLVED OXYGEN, MG/L:				
CORE PARAMETERS, MG/L				
BIOCHEMICAL OXYGEN DEMAND:				
SUSPENDED SOLIDS:	120.	87.	89.	68.
VOLATILE SUSPENDED SOLIDS:			29.	
TOTAL NITROGEN:			5.5	
TOTAL PHOSPHORUS:			0.31	
HEAVY METALS, MG/L				
LEAD:			0.10	
MERCURY:				
ZINC:				
ARSENIC:				
BACTERIOLOGICAL, MPN				
TOTAL COLIFORMS:				
FECAL COLIFORMS:				
FECAL STREPTOCCI:				
OTHER CONSTITUENTS, MG/L				
CHEMICAL OXYGEN DEMAND:				
TOTAL HYDROCARBONS:				
OIL AND GREASE:				
ALKALINITY:				

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SANTA CLARA

STATION NUMBER 3
STORM NUMBER 1

PAGE NUMBER 1
MONITORING DATA

DATE: 11/11/76 THRU 11/11/76

SAMPLE NUMBER:	1	2	3	4	6	8	9	10	12	COMPOSITE
GENERAL DATA										
TIME:	910	925	940	955	1025	1055	1110	1140	1240	
RAINFALL, INCHES:	0.01	0.02	0.02	0.02	0.01	0.01	0.06	0.06	0.10	
FLOW, CFS:	0.33	0.56	0.56	0.33	0.79	0.69	1.02	1.36	0.33	
FLOW, MGD:	0.213	0.362	0.362	0.213	0.510	0.446	0.659	0.879	0.213	
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	18.	14.	16.	18.	11.	10.		7.	10.	
SUSPENDED SOLIDS:	225.	100.	90.	60.	72.	58.		58.	84.	
VOLATILE SUSPENDED SOLIDS:	89.	68.	54.	52.	56.	46.		56.	46.	
TOTAL NITROGEN:	7.8	4.9	6.4	4.6	5.1	2.6	2.5		6.6	
TOTAL PHOSPHORUS:	0.76	0.48	0.34	0.26	0.40	0.44		0.32	0.56	
HEAVY METALS, MG/L										
LEAD:	5.5		8.6		2.6				3.1	
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										118.6
TOTAL HYDROCARBONS:										
OIL AND GREASE:										44.3
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SANTA CLARA

STATION NUMBER 3
STORM NUMBER 3

PAGE NUMBER 1
MONITORING DATA

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	2132	2145	2200	2215	2230	2245	2315	2330	0	30
RAINFALL, INCHES:			0.02	0.02	0.02	0.02	0.02	0.03	0.10	0.11
FLOW, CFS:	0.46	0.46	0.56	0.63	0.46	0.46	1.25	1.59	1.15	1.02
FLOW, MGD:	0.297	0.297	0.362	0.407	0.297	0.297	0.807	1.02	0.743	0.659
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:		51.9		3.0		23.4		8.7		13.4
SUSPENDED SOLIDS:	306.		140.		46.		342.		108.	
VOLATILE SUSPENDED SOLIDS:	96.		44.		20.		88.		30.	
TOTAL NITROGEN:	17.0		11.5		6.5		4.7		3.5	
TOTAL PHOSPHORUS:		0.42		0.27		0.20		0.25		0.31
HEAVY METALS, MG/L										
LEAD:										
MERCURY:										
ZINC.										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SANTA CLARA

STATION NUMBER 3
STORM NUMBER 3

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	11	12	13	14	COMPOSITE
GENERAL DATA					
TIME:	100	130	230	330	
RAINFALL, INCHES:	0.03	0.03	0.04		
FLOW, CFS:	2.50	0.79	0.46	0.86	
FLOW, MGD:	1.61	0.510	0.297	0.556	
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					4.
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:		8.8		10.8	
SUSPENDED SOLIDS:	112.		46.		
VOLATILE SUSPENDED SOLIDS:	28.		14.		
TOTAL NITROGEN:	2.2		4.1		
TOTAL PHOSPHORUS:		0.27		0.20	
HEAVY METALS, MG/L					
LEAD:					2.6
MERCURY:					
ZINC:					1.1
ARSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					
OIL AND GREASE:					4.
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SANTA CLARA

STATION NUMBER 3
STORM NUMBER 8

PAGE NUMBER 1
MONITORING DATA

DATE: 3/15/77 THRU 3/15/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1140	1155	1210	1225	1240	1255	1310	1325	1340	1410
RAINFALL, INCHES:		0.02				0.02				0.06
FLOW, CFS:	0.15	0.17	0.15	0.15	0.15	0.17	0.17	0.42	0.42	0.27
FLOW, MGD:	0.097	0.110	0.097	0.097	0.097	0.110	0.110	0.271	0.271	0.174
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	9.			23.				15.		15.
SUSPENDED SOLIDS:	31.	56.	62.	90.	49.	51.	43.	108.	97.	68.
VOLATILE SUSPENDED SOLIDS:	8.			28.				29.		21.
TOTAL NITROGEN:	2.1			3.8				2.2		1.9
TOTAL PHOSPHORUS:	0.11			0.22				0.28		0.17
HEAVY METALS, MG/L										
LEAD:	0.52			3.80				4.30		3.30
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SANTA CLARA

STATION NUMBER 3
STORM NUMBER 8

DATE: 3/15/77 THRU 3/15/77

SAMPLE NUMBER:	11	12	13	14	COMPOSITE
GENERAL DATA					
TIME:	1440	1510	1540	1610	
RAINFALL, INCHES:		0.05		0.10	
FLOW, CFS:	0.48	0.42	0.48	0.52	
FLOW, MGD:	0.310	0.271	0.310	0.336	
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:		14.		13.	
SUSPENDED SOLIDS:	107.	68.	54.	96.	
VOLATILE SUSPENDED SOLIDS:		24.		28.	
TOTAL NITROGEN:		2.2		2.2	
TOTAL PHOSPHORUS:		0.19		0.24	
HEAVY METALS, MG/L					
LEAD:		0.58		0.40	
MERCURY:					
ZINC:					0.76
ARSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					
OIL AND GREASE:					1.
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SAN JOSE DOWNTOWN

STATION NUMBER 4
STORM NUMBER 1

PAGE NUMBER 1
MONITORING DATA

DATE: 11/11/76 THRU 11/11/76

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	930	945	1015	1045	1100	1115	1130	1145	1200	1230
RAINFALL, INCHES:	0.03	0.04	0.01	0.01	0.03	0.03	0.03	0.03	0.05	0.05
FLOW, CFS:	0.34	0.46	0.92	0.57	0.46	1.60	1.83	1.83	0.46	0.23
FLOW, MGD:	0.220	0.297	0.594	0.368	0.297	1.03	1.18	1.18	0.297	0.149
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	<3.	<3.			30.	28.	18.			17.
SUSPENDED SOLIDS:	30.	6.		120.		96.	260.	244.	60.	
VOLATILE SUSPENDED SOLIDS:	22.	<1.		60.		48.	88.	56.	14.	
TOTAL NITROGEN:	26.4		10.8			7.7	5.5			4.0
TOTAL PHOSPHORUS:	2.24					1.12	0.80		0.61	0.54
HEAVY METALS, MG/L										
LEAD:	0.85					1.15	1.45			
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SAN JOSE DOWNTOWN

STATION NUMBER 4
STORM NUMBER 1

MONITORING DATA

DATE: 11/11/76 THRU 11/11/76

SAMPLE NUMBER:	11 COMPOSITE
GENERAL DATA	
TIME:	1300
RAINFALL, INCHES:	
FLOW, CFS:	0.23
FLOW, MGD:	0.149
FIELD DATA	
TEMPERATURE, DEGREES C:	
PH:	
DISSOLVED OXYGEN, MG/L:	
CORE PARAMETERS, MG/L	
BIOCHEMICAL OXYGEN DEMAND:	20.
SUSPENDED SOLIDS:	0.
VOLATILE SUSPENDED SOLIDS:	
TOTAL NITROGEN:	3.9
TOTAL PHOSPHORUS:	0.64
HEAVY METALS, MG/L	
LEAD:	0.47
MERCURY:	
ZINC:	
ARSENIC:	
BACTERIOLOGICAL, MPN	
TOTAL COLIFORMS:	
FECAL COLIFORMS:	
FECAL STREPTOCCI:	
OTHER CONSTITUENTS, MG/L	
CHEMICAL OXYGEN DEMAND:	254.6
TOTAL HYDROCARBONS:	
OIL AND GREASE:	41.5
ALKALINITY:	

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SAN JOSE DOWNTOWN

STATION NUMBER 4
STORM NUMBER 3

PAGE NUMBER 1
MONITORING DATA

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	1	2	3	4	5	7	8	9	10	11
GENERAL DATA										
TIME:	2150	2205	2225	2235	2250	2320	2335	2350	20	50
RAINFALL, INCHES:		0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.10	0.11
FLOW, CFS:	0.77	0.93	0.39	0.39	0.16	1.55	3.09	2.48	1.16	0.39
FLOW, MGD:	0.497	0.601	0.252	0.252	0.103	1.00	1.99	1.60	0.749	0.252
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:		<3.0		52.0			17.3	12.8		12.2
SUSPENDED SOLIDS:	266.	220.		68.			208.	170.		24.
VOLATILE SUSPENDED SOLIDS:	106.	120.		56.			98.	46.		20.
TOTAL NITROGEN:	26.9		10.0		10.0	5.7	4.4		3.4	4.1
TOTAL PHOSPHORUS:	2.74		0.66		0.48	0.62	0.44		0.28	0.25
HEAVY METALS, MG/L										
LEAD:										
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SAN JOSE DOWNTOWN

STATION NUMBER 4
STORM NUMBER 3

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	12	COMPOSITE
GENERAL DATA		
TIME:	120	
RAINFALL, INCHES:	0.06	
FLOW, CFS:	0.16	
FLOW, MGD:	0.103	
FIELD DATA		
TEMPERATURE, DEGREES C:		
PH:		
DISSOLVED OXYGEN, MG/L:		14.
CORE PARAMETERS, MG/L		
BIOCHEMICAL OXYGEN DEMAND:		
SUSPENDED SOLIDS:	22.	
VOLATILE SUSPENDED SOLIDS:	6.	
TOTAL NITROGEN:		
TOTAL PHOSPHORUS:		
HEAVY METALS, MG/L		
LEAD:		1.
MERCURY:		
ZINC:		0.2
ARSENIC:		
BACTERIOLOGICAL, MPN		
TOTAL COLIFORMS:		
FECAL COLIFORMS:		
FECAL STREPTOCCI:		
OTHER CONSTITUENTS, MG/L		
CHEMICAL OXYGEN DEMAND:		
TOTAL HYDROCARBONS:		
OIL AND GREASE:		14.
ALKALINITY:		

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SAN JOSE DOWNTOWN

STATION NUMBER 4
STORM NUMBER 8

PAGE NUMBER 1
MONITORING DATA

DATE: 3/15/77 THRU 3/15/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1235	1305	1322	1337	1352	1407	1422	1437	1452	1507
RAINFALL, INCHES:		0.02				0.06				0.05
FLOW, CFS:	0.11	0.11	0.11	0.42	0.37	0.21	0.26	0.32	0.42	0.47
FLOW, MGD:	0.071	0.071	0.071	0.271	0.239	0.136	0.168	0.207	0.271	0.304
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	48.			55.		25.		28.		21.
SUSPENDED SOLIDS:	65.	29.	35.	125.	55.	90.	53.	89.	66.	109.
VOLATILE SUSPENDED SOLIDS:	28.			110.		39.		40.		55.
TOTAL NITROGEN:	4.7			5.0		3.0		2.4		2.4
TOTAL PHOSPHORUS:	0.47			0.81		0.47		0.38		0.38
HEAVY METALS, MG/L										
LEAD:	0.72			2.00		0.92		0.74		0.78
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
SAN JOSE DOWNTOWN

STATION NUMBER 4
STORM NUMBER 8

MONITORING DATA

DATE: 3/15/77 THRU 3/15/77

SAMPLE NUMBER:	11	12	13	14	COMPOSITE
GENERAL DATA					
TIME:	1537	1607	1637	1707	
RAINFALL, INCHES:		0.10		0.09	
FLOW, CFS:	0.26	0.37	0.58	0.58	
FLOW, MGD:	0.168	0.239	0.375	0.375	
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:		16.		16.	
SUSPENDED SOLIDS:	56.	67.	210.	90.	
VOLATILE SUSPENDED SOLIDS:		29.		37.	
TOTAL NITROGEN:		1.9		4.9	
TOTAL PHOSPHORUS:		0.30		0.27	
HEAVY METALS, MG/L					
LEAD:		0.81		0.18	
MERCURY:					
ZINC:					0.16
ARSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					
OIL AND GREASE:					1.
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
GUADALUPE

STATION NUMBER 5
STORM NUMBER 3

PAGE NUMBER 1
MONITORING DATA

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	1	3	4	6	8	10	11	COMPOSITE
GENERAL DATA								
TIME:	2320	20	50	150	250	350	420	
RAINFALL, INCHES:	0.05	0.10	0.11	0.06	0.04		0.13	
FLOW, CFS:	11.	112.	193.	169.	214.	345.	375.	
FLOW, MGD:	7.1	72.3	124.	109.	138.	222.	242.	
FIELD DATA								
TEMPERATURE, DEGREES C:								
PH:								
DISSOLVED OXYGEN, MG/L:								
CORE PARAMETERS, MG/L								
BIOCHEMICAL OXYGEN DEMAND:	8.1	32.1	<3.0	21.8	30.4	<3.0	26.4	
SUSPENDED SOLIDS:	44.	198.	334.	168.	352.	682.	610.	
VOLATILE SUSPENDED SOLIDS:	18.	66.	88.	52.	76.	130.	118.	
TOTAL NITROGEN:	1.9	5.2	5.7	9.5	6.7	6.8	5.2	
TOTAL PHOSPHORUS:	0.41	0.73	0.79	0.67	0.77	0.94	0.88	
HEAVY METALS, MG/L								
LEAD:								0.17
MERCURY:								
ZINC:								0.74
ARSENIC:								
BACTERIOLOGICAL, MPN								
TOTAL COLIFORMS:								
FECAL COLIFORMS:								
FECAL STREPTOCCI:								
OTHER CONSTITUENTS, MG/L								
CHEMICAL OXYGEN DEMAND:								
TOTAL HYDROCARBONS:								2.47
OIL AND GREASE:								
ALKALINITY:								

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
GUADALUPE

STATION NUMBER 5
STORM NUMBER 4

PAGE NUMBER 1
MONITORING DATA

DATE: 2/ 8/77 THRU 2/ 8/77

SAMPLE NUMBER:	1	2	3	4	5	COMPOSITE
GENERAL DATA						
TIME:	500	530	600	630	700	
RAINFALL, INCHES:	0.01	0.01	0.01	0.01		
FLOW, CFS:	0.26	0.26	0.42	0.59	0.59	
FLOW, MGD:	0.168	0.168	0.271	0.381	0.381	
FIELD DATA						
TEMPERATURE, DEGREES C:						
PH:						
DISSOLVED OXYGEN, MG/L:						
CORE PARAMETERS, MG/L						
BIOCHEMICAL OXYGEN DEMAND:	4.2		<3.0		<3.0	
SUSPENDED SOLIDS:	13.		12.		4.	
VOLATILE SUSPENDED SOLIDS:	13.		12.		4.	
TOTAL NITROGEN:		3.7		1.8		
TOTAL PHOSPHORUS:		0.42		0.09		
HEAVY METALS, MG/L						
LEAD:						<0.08
MERCURY:						
ZINC:						0.1
ARSENIC:						
BACTERIOLOGICAL, MPN						
TOTAL COLIFORMS:						
FECAL COLIFORMS:						
FECAL STREPTOCCI:						
OTHER CONSTITUENTS, MG/L						
CHEMICAL OXYGEN DEMAND:						
TOTAL HYDROCARBONS:						<0.1
OIL AND GREASE:						
ALKALINITY:						

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
GUADALUPE

STATION NUMBER 5
STORM NUMBER 8

PAGE NUMBER 1
MONITORING DATA

DATE: 3/15/77 THRU 3/15/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1230	1300	1330	1400	1430	1500	1530	1600	1630	1700
RAINFALL, INCHES:		0.02		0.06		0.05		0.10		0.09
FLOW, CFS:	1.5	1.5	1.9	3.5	11.0	20.0	40.0	63.0	106.0	163.0
FLOW, MGD:	0.969	0.969	1.22	2.26	7.10	12.9	25.8	40.6	68.4	105.
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	8.					19.		19.		19.
SUSPENDED SOLIDS:	12.	11.	30.	8.	57.	74.	110.	151.	149.	255.
VOLATILE SUSPENDED SOLIDS:	8.					21.		42.		54.
TOTAL NITROGEN:	1.5					1.8		3.1		3.5
TOTAL PHOSPHORUS:	0.28					0.51		0.51		0.62
HEAVY METALS, MG/L										
LEAD:						<0.08				<0.08
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:							240000.			
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
GUADALUPE

STATION NUMBER 5
STORM NUMBER 8

PAGE NUMBER 2
MONITORING DATA

DATE: 3/15/77 THRU 3/15/77

SAMPLE NUMBER:	11	12	13	14	15	16	17	18	19	20
GENERAL DATA										
TIME:	1730	1800	1830	1900	1930	2000	2030	2100	2130	2200
RAINFALL, INCHES:		0.14		0.11		0.07		0.04		0.05
FLOW, CFS:	205.0	275.0	334.0	441.0	487.0	505.0	493.0	463.0	424.0	377.0
FLOW, MGD:	132.	177.	215.	284.	314.	326.	318.	299.	273.	243.
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:		21.		27.			18.			14.
SUSPENDED SOLIDS:	232.	332.	378.	700.	550.	384.	394.	408.	450.	428.
VOLATILE SUSPENDED SOLIDS:				118.			70.			66.
TOTAL NITROGEN:		4.0		6.0			2.8			2.7
TOTAL PHOSPHORUS:		0.67		0.94			0.66			0.59
HEAVY METALS, MG/L										
LEAD:				0.08						0.08
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:	240000.				160000.					160000.
FECAL COLIFORMS:	4900.				4900.					17000.
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
GUADALUPE

STATION NUMBER 5
STORM NUMBER 8

MONITORING DATA

DATE: 3/15/77 THRU 3/15/77

SAMPLE NUMBER:	COMPOSITE
GENERAL DATA	
TIME:	
RAINFALL, INCHES:	
FLOW, CFS:	
FLOW, MGD:	
FIELD DATA	
TEMPERATURE, DEGREES C:	
PH:	
DISSOLVED OXYGEN, MG/L:	
CORE PARAMETERS, MG/L	
BIOCHEMICAL OXYGEN DEMAND:	
SUSPENDED SOLIDS:	
VOLATILE SUSPENDED SOLIDS:	
TOTAL NITROGEN:	
TOTAL PHOSPHORUS:	
HEAVY METALS, MG/L	
LEAD:	
MERCURY:	
ZINC:	0.04
ARSENIC:	
BACTERIOLOGICAL, MPN	
TOTAL COLIFORMS:	
FECAL COLIFORMS:	
FECAL STREPTOCCI:	
OTHER CONSTITUENTS, MG/L	
CHEMICAL OXYGEN DEMAND:	
TOTAL HYDROCARBONS:	1.42
OIL AND GREASE:	
ALKALINITY:	

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
MATADERO

STATION NUMBER 6
STORM NUMBER 2

PAGE NUMBER 1
MONITORING DATA

DATE: 11/13/76 THRU 11/14/76

SAMPLE NUMBER:	1	2	3	5	7	8	9	12	14
GENERAL DATA									
TIME:	2015	2030	2045	2115	2145	2200	2215	2345	45
RAINFALL, INCHES:	0.01	0.01	0.01	0.02	0.03				
FLOW, CFS:									
FLOW, MGD:									
FIELD DATA									
TEMPERATURE, DEGREES C:									
PH:									
DISSOLVED OXYGEN, MG/L:									
CORE PARAMETERS, MG/L									
BIOCHEMICAL OXYGEN DEMAND:	18.0	16.0	13.0	10.0	9.0	7.5	7.0	7.0	9.0
SUSPENDED SOLIDS:	32.	124.	70.	46.	8.	18.	16.	10.	50.
VOLATILE SUSPENDED SOLIDS:	4.	54.	30.	16.	8.	14.	18.	12.	36.
TOTAL NITROGEN:	6.9	4.0	4.0	2.6	4.4	3.3	3.4	3.1	2.7
TOTAL PHOSPHORUS:	0.62	0.50	0.42	0.40	0.44	0.54	0.52	0.64	0.44
HEAVY METALS, MG/L									
LEAD:		0.9	0.4						
MERCURY:									
ZINC:									
ARSENIC:									
BACTERIOLOGICAL, MPN									
TOTAL COLIFORMS:									
FECAL COLIFORMS:									
FECAL STREPTOCCI:									
OTHER CONSTITUENTS, MG/L									
CHEMICAL OXYGEN DEMAND:		127.3	80.9						
TOTAL HYDROCARBONS:									
OIL AND GREASE:		<1.0	32.5						
ALKALINITY:									

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
MATADERO

STATION NUMBER 6
STORM NUMBER 6

DATE: 2/28/77 THRU 2/28/77

SAMPLE NUMBER:	1	2	3	4	5	6
GENERAL DATA						
TIME:	1000	1015	1030	1100	1130	1200
RAINFALL, INCHES:	0.01			0.03		
FLOW, CFS:	0.7	0.3	0.3	0.2	0.1	0.1
FLOW, MGD:	0.452	0.194	0.194	0.129	0.065	0.065
FIELD DATA						
TEMPERATURE, DEGREES C:						
PH:						
DISSOLVED OXYGEN, MG/L:						
CORE PARAMETERS, MG/L						
BIOCHEMICAL OXYGEN DEMAND:	83.0		82.0	41.2	18.7	
SUSPENDED SOLIDS:	171.	38.	27.	11.	6.	2.
VOLATILE SUSPENDED SOLIDS:	45.	16.		4.		
TOTAL NITROGEN:	4.20		1.60		4.04	
TOTAL PHOSPHORUS:	0.49		0.31		0.33	
HEAVY METALS, MG/L						
LEAD:	0.58		0.42		0.35	
MERCURY:						
ZINC:						
ARSENIC:						
BACTERIOLOGICAL, MPN						
TOTAL COLIFORMS:						
FECAL COLIFORMS:						
FECAL STREPTOCCI:						
OTHER CONSTITUENTS, MG/L						
CHEMICAL OXYGEN DEMAND:						
TOTAL HYDROCARBONS:						
OIL AND GREASE:						
ALKALINITY:						

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
MATADERO

STATION NUMBER 6
STORM NUMBER 9

PAGE NUMBER I
MONITORING DATA

DATE: 3/24/77 THRU 3/24/70

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	930	1000	1015	1030	1045	1100	1115	1130	1200	1230
RAINFALL, INCHES:	0.02							0.07		
FLOW, CFS:	0.66	0.17	0.08	0.08	0.26	0.08	0.70	0.70	0.17	2.78
FLOW, MGD:	0.426	0.110	0.052	0.052	0.168	0.052	0.452	0.452	0.110	1.79
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	16.				18.		22.		13.	
SUSPENDED SOLIDS:	100.	43.	25.	30.	33.	31.	47.	57.	30.	90.
VOLATILE SUSPENDED SOLIDS:	23.				14.		15.		4.	
TOTAL NITROGEN:	2.96				3.61		3.08		2.70	
TOTAL PHOSPHORUS:	0.38				0.49		0.34		0.27	
HEAVY METALS, MG/L										
LEAD:	0.55				0.58		0.85		0.58	
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
MATADERO

STATION NUMBER 6
STORM NUMBER 9

PAGE NUMBER 2
MONITORING DATA

DATE: 3/24/77 THRU 3/24/70

SAMPLE NUMBER:	11	12	13	COMPOSITE
GENERAL DATA				
TIME:	1300	1330	1400	
RAINFALL, INCHES:		0.16		
FLOW, CFS:	0.17	0.17	0.08	
FLOW, MGD:	0.110	0.110	0.052	
FIELD DATA				
TEMPERATURE, DEGREES C:				
PH:				
DISSOLVED OXYGEN, MG/L:				
CORE PARAMETERS, MG/L				
BIOCHEMICAL OXYGEN DEMAND:	8.		4.	
SUSPENDED SOLIDS:	22.	9.	1.	
VOLATILE SUSPENDED SOLIDS:	5.			
TOTAL NITROGEN:	2.23		2.48	
TOTAL PHOSPHORUS:	0.24		0.38	
HEAVY METALS, MG/L				
LEAD:	0.38		0.10	
MERCURY:				
ZINC:				
ARSENIC:				
BACTERIOLOGICAL, MPN				
TOTAL COLIFORMS:				
FECAL COLIFORMS:				
FECAL STREPTOCCI:				
OTHER CONSTITUENTS, MG/L				
CHEMICAL OXYGEN DEMAND:				
TOTAL HYDROCARBONS:				
OIL AND GREASE:				124.
ALKALINITY:				

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 1

PAGE NUMBER 1
MONITORING DATA

DATE: 11/11/76 THRU 11/11/76

SAMPLE NUMBER:	1	2	3
GENERAL DATA			
TIME:	1130	1200	1230
RAINFALL, INCHES:	0.12	0.05	0.05
FLOW, CFS:	19.6	26.5	15.0
FLOW, MGD:	12.60	17.10	9.69
FIELD DATA			
TEMPERATURE, DEGREES C:			
PH:			
DISSOLVED OXYGEN, MG/L:			
CORE PARAMETERS, MG/L			
BIOCHEMICAL OXYGEN DEMAND:	8.		26.
SUSPENDED SOLIDS:	464.	956.	2252.
VOLATILE SUSPENDED SOLIDS:	80.	168.	604.
TOTAL NITROGEN:			
TOTAL PHOSPHORUS:			
HEAVY METALS, MG/L			
LEAD:			
MERCURY:			
ZINC:			
ARSENIC:			
BACTERIOLOGICAL, MPN			
TOTAL COLIFORMS:			
FECAL COLIFORMS:			
FECAL STREPTOCCI:			
OTHER CONSTITUENTS, MG/L			
CHEMICAL OXYGEN DEMAND:			
TOTAL HYDROCARBONS:			
OIL AND GREASE:			
ALKALINITY:			

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 2

PAGE NUMBER 1
MONITORING DATA

DATE: 11/13/76 THRU 11/14/76

SAMPLE NUMBER:	1	3	5	7	9	10	11	14	15	COMPOSITE
GENERAL DATA										
TIME:	2025	2055	2125	2155	2240	2310	2340	215	245	
RAINFALL, INCHES:	0.01	0.02	0.02	0.03				0.05	0.06	
FLOW, CFS:	0.06	0.06	0.34	1.05	2.69	2.20	1.21	32.40	31.60	
FLOW, MGD:	0.039	0.039	0.220	0.678	1.73	1.42	0.782	20.9	20.4	
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	<3.	<3.	<3.	15.	73.	39.	23.	13.	13.	
SUSPENDED SOLIDS:	14.	26.	172.	164.	192.	120.	74.	1822.	2102.	
VOLATILE SUSPENDED SOLIDS:	6.	4.	14.	42.	44.	32.	16.	210.	234.	
TOTAL NITROGEN:	1.6	1.2	1.3	2.3	7.2	4.5	4.0	5.7	5.5	
TOTAL PHOSPHORUS:	0.46	0.50	0.62	0.80	1.42	0.90	0.82	1.22	1.10	
HEAVY METALS, MG/L										
LEAD:					0.45					0.35
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										152.
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 3

PAGE NUMBER 1
MONITORING DATA

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	2215	2245	2315	2345	15	45	115	145	215	245
RAINFALL, INCHES:	0.04	0.04	0.03	0.02	0.10	0.11	0.03	0.03	0.02	0.02
FLOW, CFS:	1.4	17.5	18.5	57.4	83.6	57.4	64.5	71.0	38.2	25.8
FLOW, MGD:	0.904	11.3	11.9	37.0	54.0	37.0	41.6	45.8	24.6	16.6
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	25.0	15.9	3.0		3.5		2.0		5.0	
SUSPENDED SOLIDS:	738.	652.	204.		70.		46.		112.	
VOLATILE SUSPENDED SOLIDS:	104.	116.	46.		34.		12.		22.	
TOTAL NITROGEN:	3.1	2.5		1.0		2.9		2.1		2.0
TOTAL PHOSPHORUS:	0.71	0.63		0.25		0.20		0.24		0.19
HEAVY METALS, MG/L										
LEAD:										
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 3

DATE: 12/29/76 THRU 12/30/76

SAMPLE NUMBER:	11	12	13	14	COMPOSITE
GENERAL DATA					
TIME:	315	345	415	445	
RAINFALL, INCHES:			0.06	0.07	
FLOW, CFS:	22.0	34.0	38.2	23.8	
FLOW, MGD:	14.2	21.9	24.6	15.3	
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:	3.0		3.5		
SUSPENDED SOLIDS:	94.		64.		
VOLATILE SUSPENDED SOLIDS:	32.		28.		
TOTAL NITROGEN:		2.3		2.8	
TOTAL PHOSPHORUS:		0.18		0.16	
HEAVY METALS, MG/L					
LEAD:					0.01
MERCURY:					
ZINC:					
ARSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					
OIL AND GREASE:					
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 4

MONITORING DATA

DATE: 2/ 8/77 THRU 2/ 8/77

SAMPLE NUMBER:	1	3	5	7	9	11	13
GENERAL DATA							
TIME:	500	600	700	800	900	1000	1100
RAINFALL, INCHES:	0.02	0.02					
FLOW, CFS:	0.4	15.9	5.7	2.9	1.5	0.7	0.3
FLOW, MGD:	0.258	10.2	3.68	1.87	0.969	0.452	0.194
FIELD DATA							
TEMPERATURE, DEGREES C:							
PH:							
DISSOLVED OXYGEN, MG/L:							
CORE PARAMETERS, MG/L							
BIOCHEMICAL OXYGEN DEMAND:	<3.	<3.	<3.	<3.	<3.	<3.	<3.
SUSPENDED SOLIDS:	35.	18.	12.	10.	7.	5.	4.
VOLATILE SUSPENDED SOLIDS:	11.	14.	12.	8.	7.	5.	4.
TOTAL NITROGEN:	1.1	0.9	1.0	1.3	1.1	0.9	0.9
TOTAL PHOSPHORUS:	0.21	0.11	0.08	0.08	0.09	0.09	0.11
HEAVY METALS, MG/L							
LEAD:	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
MERCURY:							
ZINC:							
ARSENIC:							
BACTERIOLOGICAL, MPN							
TOTAL COLIFORMS:							
FECAL COLIFORMS:							
FECAL STREPTOCCI:							
OTHER CONSTITUENTS, MG/L							
CHEMICAL OXYGEN DEMAND:							
TOTAL HYDROCARBONS:							
OIL AND GREASE:							
ALKALINITY:							

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 5

PAGE NUMBER 1
MONITORING DATA

DATE: 2/21/77 THRU 2/21/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	745	815	845	915	945	1015	1045	1115	1145	1215
RAINFALL, INCHES:	0.02	0.01	0.01	0.01				0.01		
FLOW, CFS:	0.9	49.7	30.9	42.8	47.7	29.4	24.5	20.2	14.5	9.3
FLOW, MGD:	0.581	32.1	19.9	27.6	30.8	18.9	15.8	13.0	9.36	6.00
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:										
SUSPENDED SOLIDS:	58.	23.	27.	30.	36.	66.	96.	180.	96.	67.
VOLATILE SUSPENDED SOLIDS:										
TOTAL NITROGEN:										
TOTAL PHOSPHORUS:										
HEAVY METALS, MG/L										
LEAD:										
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 5

PAGE NUMBER 2
MONITORING DATA

DATE: 2/21/77 THRU 2/21/77

SAMPLE NUMBER:	11	12	13	14
GENERAL DATA				
TIME:	1245	1315	1345	1415
RAINFALL, INCHES:				
FLOW, CFS:	6.3	4.4	3.1	2.2
FLOW, MGD:	4.07	2.84	2.00	1.42
FIELD DATA				
TEMPERATURE, DEGREES C:				
PH:				
DISSOLVED OXYGEN, MG/L:				
CORE PARAMETERS, MG/L				
BIOCHEMICAL OXYGEN DEMAND:				
SUSPENDED SOLIDS:	51.	52.	35.	44.
VOLATILE SUSPENDED SOLIDS:				
TOTAL NITROGEN:				
TOTAL PHOSPHORUS:				
HEAVY METALS, MG/L				
LEAD:				
MERCURY:				
ZINC:				
ARSENIC:				
BACTERIOLOGICAL, MPN				
TOTAL COLIFORMS:				
FECAL COLIFORMS:				
FECAL STREPTOCCI:				
OTHER CONSTITUENTS, MG/L				
CHEMICAL OXYGEN DEMAND:				
TOTAL HYDROCARBONS:				
OIL AND GREASE:				
ALKALINITY:				

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 7

MONITORING DATA

DATE: 3/ 9/77 THRU 3/ 9/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8
GENERAL DATA								
TIME:	815	845	915	945	1015	1045	1115	1145
RAINFALL, INCHES:	0.15		0.01					
FLOW, CFS:								
FLOW, MGD:								
FIELD DATA								
TEMPERATURE, DEGREES C:								
PH:								
DISSOLVED OXYGEN, MG/L:								
CORE PARAMETERS, MG/L								
BIOCHEMICAL OXYGEN DEMAND:								
SUSPENDED SOLIDS:	433.	1218.	616.	1216.	2628.	2568.	1052.	596.
VOLATILE SUSPENDED SOLIDS:	68.		96.		308.		108.	
TOTAL NITROGEN:	3.1		6.1		12.1		6.0	
TOTAL PHOSPHORUS:	0.40		0.92		2.02		1.12	
HEAVY METALS, MG/L								
LEAD:	<0.1		<0.1		<0.1		<0.1	
MERCURY:								
ZINC:								
ARSENIC:								
BACTERIOLOGICAL, MPN								
TOTAL COLIFORMS:								
FECAL COLIFORMS:								
FECAL STREPTOCCI:								
OTHER CONSTITUENTS, MG/L								
CHEMICAL OXYGEN DEMAND:								
TOTAL HYDROCARBONS:								
OIL AND GREASE:								
ALKALINITY:								

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 8

PAGE NUMBER 1
MONITORING DATA

DATE: 3/15/77 THRU 3/16/77

SAMPLE NUMBER:	1	2	3	4	5	6	7	8	9	10
GENERAL DATA										
TIME:	1430	1500	1530	1600	1630	1700	1730	1800	1830	1900
RAINFALL, INCHES:		0.05		0.10		0.09		0.14		0.11
FLOW, CFS:	2.2	10.0	25.2	20.8	31.6	54.0	55.6	64.6	72.3	82.1
FLOW, MGD:	1.42	6.46	16.2	13.4	20.4	34.8	35.9	41.7	46.7	53.0
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	11.0		15.0		11.0		10.0		10.0	
SUSPENDED SOLIDS:	225.	247.	536.	488.	558.	1060.	1530.	1846.	2616.	2802.
VOLATILE SUSPENDED SOLIDS:	21.		68.		58.		136.		190.	
TOTAL NITROGEN:	1.5		3.5		3.5		4.7		5.2	
TOTAL PHOSPHORUS:	0.44		0.86		0.90		1.21		1.46	
HEAVY METALS, MG/L										
LEAD:	<0.08		0.34		0.29		0.18		0.16	
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 8

PAGE NUMBER 2
MONITORING DATA

DATE: 3/15/77 THRU 3/16/77

SAMPLE NUMBER:	11	12	13	14	15	16	17	18	19	20
GENERAL DATA										
TIME:	1930	2030	2130	2230	2330	30	130	230	330	430
RAINFALL, INCHES:	0.02	0.04	0.05	0.09	0.11	0.11	0.08	0.01	0.01	0.01
FLOW, CFS:	83.6	57.4	45.7	44.7	59.7	77.8	73.7	42.8	33.2	23.2
FLOW, MGD:	54.0	37.0	29.5	28.8	38.5	50.2	47.6	27.6	21.4	14.9
FIELD DATA										
TEMPERATURE, DEGREES C:										
PH:										
DISSOLVED OXYGEN, MG/L:										
CORE PARAMETERS, MG/L										
BIOCHEMICAL OXYGEN DEMAND:	8.5	9.0		6.0		6.0			5.0	
SUSPENDED SOLIDS:	3410.	2900.	1918.	1124.	848.	1094.	1154.	1882.	1562.	1106.
VOLATILE SUSPENDED SOLIDS:	590.			90.		86.			126.	
TOTAL NITROGEN:	4.5	6.0		2.7		3.5			4.9	
TOTAL PHOSPHORUS:	1.94	2.10		1.32		1.19			1.35	
HEAVY METALS, MG/L										
LEAD:	0.15									
MERCURY:										
ZINC:										
ARSENIC:										
BACTERIOLOGICAL, MPN										
TOTAL COLIFORMS:										
FECAL COLIFORMS:										
FECAL STREPTOCCI:										
OTHER CONSTITUENTS, MG/L										
CHEMICAL OXYGEN DEMAND:										
TOTAL HYDROCARBONS:										
OIL AND GREASE:										
ALKALINITY:										

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
BERRYESSA-LOWER

STATION NUMBER 7
STORM NUMBER 8

MONITORING DATA

DATE: 3/15/77 THRU 3/16/77

SAMPLE NUMBER:	21	22	23	24	25
GENERAL DATA					
TIME:	530	630	730	830	930
RAINFALL, INCHES:					
FLOW, CFS:	12.3	5.7	4.8	2.7	2.3
FLOW, MGD:	7.94	3.68	3.10	1.74	1.48
FIELD DATA					
TEMPERATURE, DEGREES C:					
PH:					
DISSOLVED OXYGEN, MG/L:					
CORE PARAMETERS, MG/L					
BIOCHEMICAL OXYGEN DEMAND:		4.0			6.0
SUSPENDED SOLIDS:	450.	435.	245.	282.	271.
VOLATILE SUSPENDED SOLIDS:		50.			38.
TOTAL NITROGEN:		3.4			3.0
TOTAL PHOSPHORUS:		0.94			0.43
HEAVY METALS, MG/L					
LEAD:					
MERCURY:					
ZINC:					
ARSENIC:					
BACTERIOLOGICAL, MPN					
TOTAL COLIFORMS:					
FECAL COLIFORMS:					
FECAL STREPTOCCI:					
OTHER CONSTITUENTS, MG/L					
CHEMICAL OXYGEN DEMAND:					
TOTAL HYDROCARBONS:					
OIL AND GREASE:					
ALKALINITY:					

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
FLOW WEIGHTED AVERAGE, MG/L

STATION NUMBER:	1	2	3	4	5	6	7	8	9	10	ALL
GENERAL DATA											
AVERAGE FLOW, CFS:	29.540		0.615	0.694	182.3	0.411	27.60				36.93
FIELD DATA											
DISSOLVED OXYGEN, MG/L:											0.00
CORE PARAMETERS, MG/L											
BIOCHEMICAL OXYGEN DEMAND:	19.230		13.010	18.990	19.020	38.120	7.879				17.43
SUSPENDED SOLIDS:	483.00		114.20	155.90	428.20	72.36	1134.				560.13
VOLATILE SUSPENDED SOLIDS:	84.31		45.84	65.12	87.97	21.50	146.4				95.09
TOTAL NITROGEN:	4.479		4.477	7.001	4.915	3.156	3.620				4.59
TOTAL PHOSPHORUS:	0.860		0.316	0.737	0.757	0.383	0.983				0.82
HEAVY METALS, MG/L											
LEAD:	0.165		3.428	1.082	0.080	0.588	0.184				0.14
MERCURY:											0.00
ZINC:											0.00
ARSENIC:											0.00
OTHER CONSTITUENTS, MG/L											
CHEMICAL OXYGEN DEMAND:											0.00
TOTAL HYDROCARBONS:											0.00
OIL AND GREASE:											0.00
ALKALINITY:											0.00

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
ARITHMETIC AVERAGE, MG/L

STATION NUMBER:	1	2	3	4	5	6	7	8	9	10	ALL
GENERAL DATA											
AVERAGE FLOW, CFS:	29.540		0.615	0.694	182.3	0.411	27.60				36.93
FIELD DATA											
DISSOLVED OXYGEN, MG/L:											0.00
CORE PARAMETERS, MG/L											
BIOCHEMICAL OXYGEN DEMAND:	16.48		14.90	22.38	15.55	21.17	10.58				15.99
SUSPENDED SOLIDS:	191.40		97.48	101.1	251.0	40.96	705.4				301.53
VOLATILE SUSPENDED SOLIDS:	50.72		44.04	51.38	56.23	18.70	93.85				58.03
TOTAL NITROGEN:	4.681		4.971	7.355	4.229	3.406	3.322				4.53
TOTAL PHOSPHORUS:	0.643		0.319	0.725	0.616	0.431	0.744				0.61
HEAVY METALS, MG/L											
LEAD:	0.189		3.270	0.915	0.080	0.517	0.145				0.67
MERCURY:											0.00
ZINC:											0.00
ARSENIC:											0.00
OTHER CONSTITUENTS, MG/L											
CHEMICAL OXYGEN DEMAND:						104.1					104.10
TOTAL HYDROCARBONS:											0.00
OIL AND GREASE:						16.75					16.75
ALKALINITY:											0.00

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
STANDARD DEVIATIONS OF THE FLOW WEIGHTED AVERAGES, MG/L

STATION NUMBER:	1	2	3	4	5	6	7	8	9	10	ALL
GENERAL DATA											
AVERAGE FLOW, CFS:	46.130		0.481	0.701	184.7	0.618	25.24				86.22
FIELD DATA											
DISSOLVED OXYGEN, MG/L:											0.00
CORE PARAMETERS, MG/L											
BIOCHEMICAL OXYGEN DEMAND:	16.29		10.01	15.68	10.69	28.93	13.46				15.40
SUSPENDED SOLIDS:	363.70		75.42	96.86	280.4	50.66	972.1				594.45
VOLATILE SUSPENDED SOLIDS:	55.47		25.15	37.52	52.31	14.96	143.7				85.02
TOTAL NITROGEN:	3.034		3.689	7.086	2.330	1.180	2.285				3.66
TOTAL PHOSPHORUS:	0.399		0.150	0.646	0.272	0.122	0.619				0.48
HEAVY METALS, MG/L											
LEAD:	0.171		2.549	0.516		0.239	0.115				1.42
MERCURY:											0.00
ZINC:											0.00
ARSENIC:											0.00
OTHER CONSTITUENTS, MG/L											
CHEMICAL OXYGEN DEMAND:											0.00
TOTAL HYDROCARBONS:											0.00
OIL AND GREASE:											0.00
ALKALINITY:											0.00

THIS IS THE RUNOFF QUALITY DATA FOR SANTA CLARA COUNTY
STANDARD DEVIATIONS OF THE ARITHMETIC AVERAGES, MG/L

STATION NUMBER:	1	2	3	4	5	6	7	8	9	10	ALL
GENERAL DATA											
AVERAGE FLOW, CFS:	46.130		0.481	0.701	184.7	0.618	25.24				86.22
FIELD DATA											
DISSOLVED OXYGEN, MG/L:											0.00
CORE PARAMETERS, MG/L											
BIOCHEMICAL OXYGEN DEMAND:	16.050		9.822	15.29	10.08	23.11	13.18				15.34
SUSPENDED SOLIDS:	215.00		73.47	79.16	214.8	39.29	871.0				535.03
VOLATILE SUSPENDED SOLIDS:	43.89		25.09	34.78	40.82	14.68	133.5				76.46
TOTAL NITROGEN:	3.027		3.654	7.077	2.220	1.151	2.265				3.66
TOTAL PHOSPHORUS:	0.334		0.150	0.645	0.230	0.112	0.570				0.43
HEAVY METALS, MG/L											
LEAD:	0.169		2.544	0.486		0.227	0.107				1.31
MERCURY:											0.00
ZINC:											0.00
ARSENIC:											0.00
OTHER CONSTITUENTS, MG/L											
CHEMICAL OXYGEN DEMAND:						23.2					23.20
TOTAL HYDROCARBONS:											0.00
OIL AND GREASE:						15.75					15.75
ALKALINITY:											0.00

APPENDIX C

IDENTIFICATION OF POTENTIAL SURFACE RUNOFF PROBLEMS

APPENDIX C

IDENTIFICATION OF POTENTIAL SURFACE RUNOFF PROBLEMS

EVALUATION OF EXISTING PROBLEMS

In an attempt to identify sources of possible contamination, assistance was solicited from the cities, county, special districts, and concerned agencies in the form of a questionnaire.

The detailed list of all the identified *potential* problem areas summarized from the thirteen questionnaires returned is presented in Table C-1.

In Santa Clara County, one of the richest mercury mining districts in the world, mercury contamination has been identified as a potential problem. The long history of mining activity has left tailings of waste rock extracted from the mines. Drainage from the mining area flows to the Almaden Reservoir, Calero Reservoir, or to Alamitos Creek and the Guadalupe River to Alviso Slough and San Francisco Bay.

The mercury in the ore is not water soluble. In its free form, mercury is associated with sediments and suspended particles. This affinity of mercury for sedimentary materials is evidenced by the low concentration of mercury in waters overlaying mercury laden sediments. The Santa Clara Valley Water District has reported that there has been no evidence of mercury contamination to the county's important groundwater source. However, analysis of various fish from the Almaden, Calero and Guadalupe Reservoirs indicated high mercury contents (0.1 - 5.1 ppm) some exceeding the accepted standard value of 0.5 ppm. This finding prompted the closing of these reservoirs and affected creeks to fishing.

After the closing of the mining activity, in a practical sense, the ultimate source of mercury in the area is the mercury ore deposits themselves. The common rocks and soils containing mercury residual erode and are transported along streams and deposited in reservoirs. Some could ultimately be deposited in sediment beds along the streams and in San Francisco Bay.

The potential public health hazards from mercury have been minimized by the present precautions and watershed management practices undertaken. The long-term ecological significance presently is undefined and warrants continuation of monitoring of mercury concentrations in both sediments and surface waters.

TABLE C-1. SUMMARY OF POTENTIAL POLLUTION SOURCES

City or agency	Description of problem	Possible solutions
City of Los Altos	Minor problems with siltation and dirt accumulation in Permanent Creek cross channel near Carmel Terrace	Annual spring cleaning of deposits
	Minor problem of local yearly flooding of a few properties along Adobe Creek	SCVWD is finalizing detailed study of flooding and erosion for Adobe Creek
	Minor problem with some infiltration into the sanitary sewer along Adobe Creek between Edith Avenue and University Terrace	Location of problem areas would facilitate elimination of this problem
Resource Conservation Districts	Siltation and dirt accumulation in storm sewers and channels but unsure of magnitude	--
	Grease, oil, or floating scum on channels or in sloughs but unsure of magnitude	--
	High bacterial levels in streams, channels, or reservoirs but unsure of magnitude	--
	Known areas of malfunctioning septic tank leach fields but unsure of magnitude	--
	Local flooding problems but unsure of magnitude	--
	Sources of agricultural return drains or feedlot pollution but unsure of magnitude	--
	High water area in south county flood plain area due to tile drain outlets	--
	Chicken operations and dairy farm problems in Evergreen area, East Gilroy, and others	Dairy waste systems have been designed and are being installed
	Small lots of heavy concentrations of horses have kept the ground bare and subject to runoff problems in most areas	--
City of San Jose	Minor problem with siltation and dirt accumulation in storm drains	
	Minor problem with oil and grease, and floating materials in stream channels	

TABLE C-1. (Continued)

City or agency	Description of problem	Possible solutions
South Santa Clara Valley Water Conservation District	Significant problem of siltation and dirt accumulation in storm sewers and channels in the entire district	Enforce existing ordinances and develop new ones
	High bacterial levels in upstream reaches and stock reservoirs due to floating dead stock carcasses and junk and garbage deposits	Enforce existing ordinances and develop new ones
	Malfunctioning septic tank leach fields in many small and large stream channels and canyons in mainly the east and west side areas of the valley and other areas on clay soil. Unsure of magnitude of problem	In areas of poor drainage, require package treatment plants and reuse of effluent water
	Significant problems of local flooding (location not specified)	--
	Inflow and/or infiltration problems into sanitary sewer system in all of Morgan Hill and areas of Gilroy	--
	Significant problems of cross-connection between storm drains and sanitary sewers in all of Morgan Hill and areas of Gilroy	--
	Overflow and/or emergency bypass of relief points on sanitary sewer system, unsure of magnitude of problem	--
	Problem of agricultural return drains or feedlot pollution but unsure of magnitude	--
	Significant problem of horse arenas in proximity of creeks and complete denuding of surface cover in horse pastures and lots	Must limit stock numbers for a given area; require drainage control and sediment ponds or traps; establish groundcover and many other options
City of Morgan Hill	Serious problem of siltation and dirt accumulation in drainage channels	
	Minor problem of floatable materials in channel	

TABLE C-1. (Continued)

City or agency	Description of problem	Possible solutions
County of Santa Clara	Minor problem of siltation and dirt accumulation in storm sewers and channels where flat gradients exist	Underpasses on county expressways must be swept with equipment and drainage inlets vacuumed. Requires additional maintenance funds.
	Grease, oil, or floating scum on channels or in sloughs in various locations but unsure of magnitude	Grease traps must be required on plans for new gas stations
	Malfunctioning septic tank leach fields in the Los Altos Hills area, but unsure of magnitude	--
	Local flooding problems in various south county locations and other areas where drainage facilities are inadequate flood control	County is involved in furnishing a south county master drainage plan and construction of drainage facilities
	Problems of unsure magnitude caused by agricultural return drains or feedlot pollution	--
City of Saratoga	Significant problem of siltation and dirt accumulation in storm sewers and channels	--
City of Sunnyvale	Minor problem of siltation and dirt accumulation in storm sewers and channels	--
	Minor problem of grease, oil, or floating scum on channels or in sloughs	--
	Minor problem of high bacterial levels in streams, channels, or reservoirs	--
	Minor problem of local flooding caused by 40-year storms or greater	--
	Minor problem of know cross-connection between storm drains and sanitary sewers	The city has removed cross-connections in the past but there are still a few to be removed as areas develop
	Significant problem of runoff from chemicals and other materials from industry storage yards and parking lots of industries	A source control program of noncompatible wastes is being conducted. The solution is to make certain that stored materials cannot leak from barrels or be spilled on ground to be washed into storm drains

TABLE C-1. (Continued)

City or agency	Description of problem	Possible solutions
City of Santa Clara	Minor problem of siltation and dirt accumulation in storm sewers but no specific location	Control by routine maintenance
	Local flooding problems at Homestead Road generally east of San Tomas Creek	Need additional storm drains to accommodate flow
	Minor problem of identified areas with inflow and/or infiltration problems into sanitary sewer system	--
City of Milpitas	Minor problem with grease, oil, or floating scum in channels or in sloughs	--
	Minor local flooding problems	--
	Minor problem of identified areas with inflow and/or infiltration problems into sanitary sewer system	--
	Minor problem with agricultural return drains or feedlot pollution at daily corner of Montague and Trimble roads	--
Town of Los Gatos	Minor problem with siltation and dirt accumulation in storm sewers and channels	Periodic cleaning and grading control
	Minor problem with malfunctioning septic tank leach fields on hillsides	Require correction and encourage sanitary sewers
	Minor local flooding problems at various locations	--
	Minor problem in older Los Gatos with inflow and/or infiltration problems into sanitary sewer system	--
County Sanitation District No. 4	Minor problem with overflow and/or emergency bypass or relief points o· sanit-ry sewer system. Problem located at two pump stations in the foothills south of the Saratoga-Los Gatos highway	There are long-range plans and budgets for the abandonment of the two remaining pump stations

TABLE C-1. (Continued)

City or agency	Description of problem	Possible solutions
City of Gilroy	Minor problem with siltation and dirt accumulation in storm sewers and channels in new hill areas only	Grading controls and slope protection
	Significant problem with high bacterial levels in streams, channels, or reservoirs in rural land developments between Gilroy and Morgan Hill	--
	Problem of unknown magnitude of known areas of malfunctioning septic tank leach fields in the rural land developments between Gilroy and Morgan Hill	--
	Significant local flooding problems north of First and between Morey and Wren Avenues	To be resolved by 566 project
	Significant problem of overflow and/or emergency bypass or relief points at the sewage treatment plant at times of heavy inflow from rural lands. Inflow is discharged into the disposal ponds.	To be resolved with construction of the new sewage treatment plant
	Problem of unknown magnitude of sources of agriculture return drains or feedlot pollution from rural land developments between Gilroy and Morgan Hill.	--
City of Cupertino	Problem of unknown magnitude of siltation and dirt accumulation in storm sewers and channels	--
	Problem of unknown magnitude of grease, oil, or floating scum on channels or in sloughs	--
	Problem of unknown magnitude of local flooding	Implementation of a storm master plan
	Problem of unknown magnitude of cross-connection between storm drains and sanitary sewers	--

TABLE C-1. (Concluded)

City or Agency	Description of problem	Possible solutions
Environmental Health Services, County of Santa Clara	Minor problem of siltation and dirt accumulation at Adobe Creek and Alma (and others)	Can be solved by more frequent clean-out
	Significant problem of oil discharge from many urban storm outfalls	Should have educational program aimed at proper disposal of recycling of waste oils
	Problem of unknown magnitude of high bacterial levels in all surface waters but varies with location	Should establish standards for coliform/fecal coliform for surface waters and provide funding for monitoring and enforcement
	Problem of unknown magnitude of malfunctioning septic tank leach fields in unsewered hill areas (e.g., Los Altos)	Should require hook-up to sanitary sewer
	Problem of unknown magnitude of cross-connection between storm drains and sanitary sewers at Howard St., San Jose and Guadalupe River	Should correct as discovered
	Problem of unknown magnitude of overflow of sanitary to storm system at San Barden Packing Co.	Should enlarge capacity of sanitary sewers by maintenance clean-out programs or construction of new sanitary lines to satisfy present and future needs
	Minor problem of sources of agriculture return drains or feedlot pollution	--
City of Mountain View	Siltation in surface channels - specific problem of oil discharge in storm drains - one cross connection of storm drain and sanitary sewer	--
	Sanitary sewer overflow	Alternatives are being investigated
	Flooding in area north of Bayshore	Pumping stations to be installed
City of Palo Alto	Siltation in surface channels, minor problem in oil discharge in storm drainage system and flooding	--

APPENDIX D

MATHEMATICAL MODEL APPLICATION

Appendix D

MATHEMATICAL MODEL APPLICATIONS

Two levels of mathematical models were used to analyze existing conditions and to predict future conditions resulting from surface runoff. The first, the Macroscopic Planning Model (MAC), looks at broad areas and long periods of record. Precision is sacrificed for breadth of coverage and for speed and flexibility in model application.

The second, the Storm Water Management Model (SWMM), is far more detailed and both site and storm specific. It is best applied to relatively small watersheds, 1 to 10 square miles, where specific control measures can be assessed.

The models were used interactively, with MAC identifying the relative importance of major watersheds toward specific problems, and SWMM providing the detailed examination and, in turn, outputting data that would improve the MAC assumptions.

The purpose of this appendix is to summarize the results of the mathematical modeling efforts, namely, an analysis and quantification of several potential problem constituents existing in the surface runoff.

MAC MODEL

Santa Clara County consists of six natural major watersheds, ranging in size from 53,000 to 245,000 acres. Each of these six watersheds was further divided into subareas based on present land use. The land use categories are (A) natural or protected, (B) nonurbanized, but potentially developable, and (C) existing urban. The result was the division of the county into 13 subareas. The watersheds and subareas are shown in Figure D-1.

Input Data

The input data needed are minimized by requiring only the hydrologic and quality parameters (area, rainfall, runoff coefficients, maximum available storage, releases from storage, and runoff quality) that have major effects on the quantity and quality of surface runoff.

Land Use Data. The land use data used for MAC model application were provided by ABAG and are shown in Table D-1. The County Planning Department reviewed the data, and, although there were some minor discrepancies, consented to the use of the Series 3 projections for MAC model application.

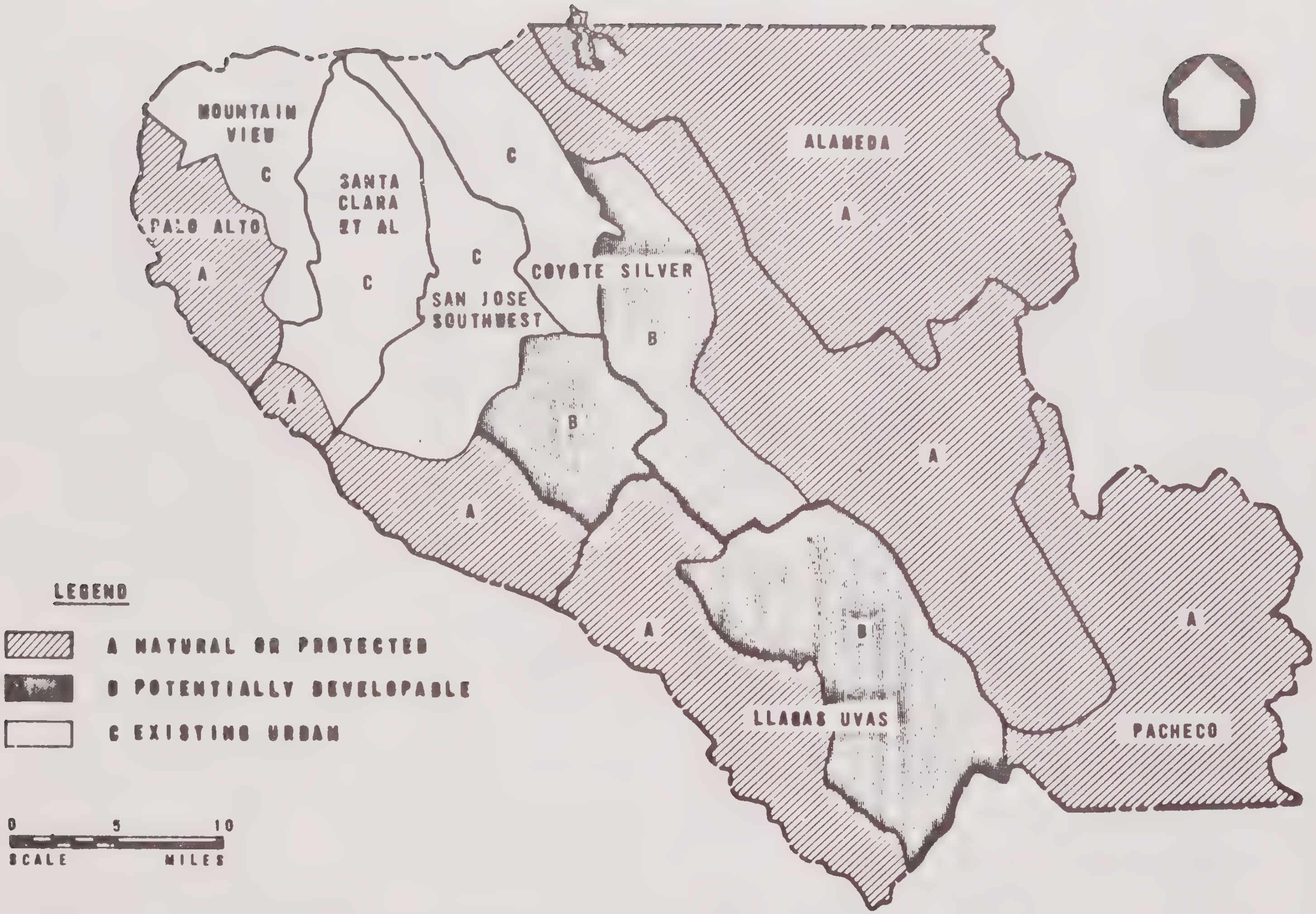


Figure D-1

MAC WATERSHED AND SUBAREA BOUNDARIES

Table D-1. MAC INPUT DATA - LAND USE PROJECTION, SANTA CLARA COUNTY

Subarea	1975 Residential	1975 Commercial	1975 Industrial	1975 Open	1985 Residential	1985 Commercial	1985 Industrial	1985 Open	2000 Residential	2000 Commercial	2000 Industrial	2000 Open
Palo Alto-Mtn. View	13,114	4,486	3,219	46,077	25,435	4,545	3,186	33,730	25,334	4,793	3,681	33,088
(A)	11,647	417	140	31,658	10,324	387	123	23,028	10,323	395	129	23,015
(C)	11,467	4,069	3,079	14,419	15,114	4,158	3,063	10,702	15,011	4,398	3,552	10,073
Santa Clara, et al.	17,071	4,444	4,047	22,853	20,787	5,333	5,090	17,205	21,263	5,645	5,930	15,577
(A)	[illegible]	0	0	2,020	2	0	0	2,020	2	0	0	2,020
(C)	17,069	4,444	4,047	20,833	20,785	5,333	5,090	15,185	21,261	5,645	5,930	13,557
San Jose southwest	24,147	6,559	5,300	76,218	28,537	7,872	5,385	68,430	36,223	8,702	6,128	59,171
(A)	103	0	63	33,826	103	0	63	33,826	103	0	63	33,826
(B)	6,342	767	467	21,898	8,320	1,189	646	19,337	15,141	1,425	761	11,147
(C)	17,702	5,792	4,770	18,494	20,132	6,683	4,676	15,267	19,979	7,277	5,304	14,198
Coyote-Silver	12,217	2,744	2,958	208,260	31,121	4,173	4,165	186,720	34,753	4,513	5,086	181,827
(A)	2	34	10	141,137	4	36	11	141,132	5	37	9	141,132
(B)	2,539	271	120	42,797	15,494	612	273	29,348	18,952	637	388	25,750
(C)	9,676	2,439	2,828	24,326	15,623	3,525	3,881	16,240	15,796	3,839	4,689	14,945
Llagas-Uvas	1,594	593	391	136,549	14,167	965	530	123,465	39,231	1,773	765	97,358
(A)	2	2	4	66,087	2,587	2	3	63,503	9,035	2	3	57,055
(B)	1,592	591	387	70,462	11,580	963	527	59,962	30,196	1,771	762	40,303
Alameda (A)	3	36	11	141,243	4	38	12	141,239	5	38	9	141,241
Pacheco (A)	2	27	8	106,887	3	29	9	106,883	[illegible]	29	7	106,884

Note: (A) = undeveloped area; (B) = developable area; (C) = urbanized area.

Rainfall Data. The historical rainfall records from 1950 to 1976 at San Jose Civic Center were used as the base rainfall data. A rainfall correlation factor was obtained from the isohyetal map of the county for each watershed subarea and the San Jose Civic Center and were used to compute the rainfall for each subarea (Table D-2).

Table D-2. MAC INPUT RAINFALL CORRECTION FACTOR, SANTA CLARA COUNTY, SAN JOSE CIVIC CENTER = 1

MAC watershed subarea	Rainfall factor
Palo Alto-Mtn. View (A)	2.5
Palo Alto-Mtn. View (C)	1.0
Santa Clara, et al. (A)	2.4
Santa Clara, et al. (C)	1.0
San Jose southwest (A)	2.4
San Jose southwest (B)	1.5
San Jose southwest (C)	1.0
Coyote-Silver (A)	1.6
Coyote-Silver (B)	1.2
Coyote-Silver (C)	1.1
Llagas-Uvas (A)	1.5
Llagas-Uvas (B)	1.5
Alameda (A)	1.2
Pacheco (A)	1.2

Runoff Coefficient. The runoff coefficients for each type of land use employed to quantify the runoff from each subarea are shown in Table D-3. The K factors for commercial and industrial areas were computed from flow measurement data obtained for each of these areas during the sampling program. The K factor for open space was determined from flow data obtained at four USGS gages located in the open areas. The K factor for residential areas was extrapolated from the flow data in a composite land use area.

Table D-3. MAC INPUT - RUNOFF COEFFICIENT, SANTA CLARA COUNTY

Land use	Runoff factor
Residential	0.27
Commercial	0.50
Industrial	0.60
Open	0.12

Runoff Quality Concentration of Potential Problem Constituents. The concentrations for each constituent were obtained from the current sampling data for each discrete land use area (Table D-4), with the exception of open space. As the result of the current drought and the lack of runoff in the open area, a data base was not established for open areas. Concentrations for suspended solids from the open areas are the weighted average of the USGS data. Concentrations for other constituents for open space were based on data obtained by other counties in the San Francisco Bay Area.

Table D-4. MAC INPUT - SURFACE RUNOFF QUALITY, SANTA CLARA COUNTY

Land use	Constituents, mg/L				
	BOD	SS	VSS	Total N	Total P
Residential	15.0	200	50	3.5	0.4
Commercial	20.0	150	70	5.0	0.7
Industrial	13.0	120	50	3.0	0.5
Open	4.0	600	90	2.0	0.3

MAC Results

The MAC results for each watershed and the entire county for the years 1975, 1985, and 2000 are summarized in Tables D-5, D-6, and D-7. The runoff quality assumptions used in this determination are based on the results of the surface runoff sampling program discussed in Appendix B. No changes in the present runoff management practices were incorporated. Thus, the results show the average annual load from each subarea for BOD_5, suspended solids, volatile suspended solids, total nitrogen, and total phosphorus. The average annual loads shown were calculated from 26 years of rainfall records using the assumed land use distribution for the year indicated (1975, 1985, and 2000).

Relationship of Surface Runoff Loads to Point Source Loads

The relationship of the surface runoff loads to the point source loads (municipal wastewater treatment plant effluent and industrial discharges) for Santa Clara County are shown in Figure D-2. In Santa Clara County, there were no significant industrial discharges identified that do not receive treatment at a municipal wastewater treatment plant. As shown in Figure D-2, the annual mass load for BOD_5, total nitrogen, and total phosphorus from the point sources exceeds that from the nonpoint sources. However, the annual mass load of total suspended solids from the surface runoff greatly exceeds the point source load.

Table D-5. TOTAL ESTIMATED POLLUTANT LOAD DUE TO SURFACE RUNOFF, SANTA CLARA COUNTY, 1975

MAJOR WATERSHED NAME	SUB-AREA NAME	AREA (ACRES)	WATERSHED CHARACHTERISTICS (CITIES CONTAINED WITHIN, TOPOGRAPHY, LAND USES)	RAINFALL YEARS USED	ANNUAL POLLUTANT LOAD (1000'S OF LBS) BOD	SS	VSS	TOTAL N	TOTAL P
PALO ALTO-MT. VIEW	PPOTECTED (A)	33,862	LOS ALTOS HILLS MODERATE TO STEEP HILLSIDES 5% RES., 1% COMM., .5% IND., 93.5% OPEN	1950-1975	161	14,630	2,320	63	9
PALO ALTO-MT. VIEW	URBAN (C)	33,034	PALO ALTO, MT. VIEW ALLUVIAL PLAIN AND BAY SHORE 35% RES., 12% COMM., 9% IND., 44% OPEN	1950-1975	344	6,451	1,611	88	12
SANTA CLARA, ET. AL.	PROTECTED (A)	2,022	NO CITIES STEEP HILLSIDES .1% RES., 99.9% OPEN	1950-1975	7	1,064	160	4	1
SANTA CLARA, ET. AL.	URBAN (C)	46,393	SUNNYVALE, CUPPERTINO, SANTA CLARA, SARATOGA ALLUVIAL PLAIN AND BAY SHORE 37% RES., 10% COMM., 9% IND., 44% OPEN	1950-1975	450	8,978	2,155	115	16
SAN JOSE SOUTHWEST	PROTECTED (A)	33,992	REDWOOD ESTATES, HOLY CITY STEEP HILLSIDES .3% RES., .2% IND., 99.5% OPEN	1950-1975	0	0	0	0	0
SAN JOSE SOUTHWEST	DEVELOPABLE (B)	29,474	NEW ALMADEN ALLUVIAL RIVER PLAIN AND MODERATE HILLSIDES 21% RES, 3% COMM., 2% IND., 74% OPEN	1950-1975	204	9,022	1,617	61	8
SAN JOSE SOUTHWEST	URBAN (C)	46,578	SAN JOSE, BURBANK, CAMPBELL CAMBRIAN PARK, LOS GATOS ALLUVIAL PLAIN, BAYSHORE AND MODERATE HILLS 38% RES., 12% COMM., 10% IND., 40% OPEN	1950-1975	512	9,024	2,312	129	18
COYOTE-SILVER	PROTECTED (A)	141,183	NO CITIES STEEP TO MODERATE HILLSIDES ~100% OPEN	1950-1975	11	1,595	239	5	1
COYOTE-SILVER	DEVELOPABLE (B)	45,727	EVERGREEN ROLLING TO STEEP HILLSIDES 6% RES., .7% COMM., .3% IND., 93% OPEN	1950-1975	122	11,829	1,851	49	7
COYOTE-SILVER	URBAN (C)	39,269	MILPITAS, BERRYESSA, ALUM ROCK ALLUVIAL PLAIN, BAY SHORE AND MODERATE HILLS 25% RES., 6% COMM., 7% IND., 62% OPEN	1950-1975	312	8,730	1,842	84	12
LLAGAS-UVAS	PROTECTED (A)	66,095	NO CITIES STEEP TO MODERATE HILLSIDES ~100% OPEN	1950-1975	52	7,815	1,172	26	4
LLAGAS-UVAS	DEVELOPABLE (B)	73,044	MORGAN HILL, SAN MARTIN, GILROY ALLUVIAL PLAIN AND ROLLING HILLS 2% RES., 1% COMM., 1% IND., 96% OPEN	1950-1975	222	23,887	3,716	93	14
ALAMEDA	PROTECTED (A)	141,293	NO CITIES STEEP HILLSIDES ~100% OPEN	1950-1975	250	37,229	5,588	124	19
PACHECO	PROTECTED (A)	106,924	NO CITIES STEEP HILLSIDES ~100% OPEN	1950-1975	189	28,173	4,229	94	14
COUNTY WIDE TOTAL		838,890			2,836	168,427	28,812	935	135

Table D-6. TOTAL ESTIMATED POLLUTANT LOAD DUE TO SURFACE RUNOFF, SANTA CLARA COUNTY, 1985

MAJOR WATERSHED NAME	SUB-AREA NAME	AREA (ACRES)	WATERSHED CHARACHTERISTICS (CITIES CONTAINED WITHIN, TOPOGRAPHY, LAND USES)	RAINFALL YEARS USED	ANNUAL POLLUTANT LOAD (1000'S OF LBS) BOD	SS	VSS	TOTAL N	TOTAL P
PALO ALTO-MT. VIEW	PROTECTED (A)	33,862	LOS ALTOS HILLS MODERATE TO STEEP HILLSIDES 30% RES., 1%COMM., .5% IND., 68.5% OPEN	1950-1975	338	13,979	2,487	98	13
PALO ALTO-MT. VIEW	URBAN (C)	33,034	PALO ALTO, MT. VIEW ALLUVIAL PLAIN AND BAY SHORE 46% RES., 13% COMM., 9% IND., 32% OPEN	1950-1975	381	6,185	1,629	95	13
SANTA CLARA, ET. AL.	PROTECTED (A)	2,022	NO CITIES STEEP HILLSIDES .1% RES., 99.9% OPEN	1950-1975	7	1,064	160	4	1
SANTA CLARA, ET. AL.	URBAN (C)	46,393	SUNNYVALE, CUPPERTINO, SANTA CLARA, SARATOGA ALLUVIAL PLAIN AND BAY SHORE 45% RES., 11% COMM., 11% IND., 33% OPEN	1950-1975	534	8,714	2,296	133	18
SAN JOSE SOUTHWEST	PROTECTED (A)	33,992	REDWOOD ESTATES, HOLY CITY STEEP HILLSIDES .3% RES., .2% IND., 99.5% OPEN	1950-1975	0	0	0	0	0
SAN JOSE SOUTHWEST	DEVELOPABLE (B)	29,474	NEW ALMADEN ALLUVIAL RIVER PLAIN AND MODERATE HILLSIDES 28% RES., 4% COMM., 2% IND., 66% OPEN	1950-1975	257	8,812	1,690	72	10
SAN JOSE SOUTHWEST	URBAN (C)	46,578	SAN JOSE, BURBANK, CAMPBELL CAMBRIAN PARK, LOS GATOS ALLUVIAL PLAIN, BAYSHORE AND MODERATE HILLS 43% RES., 14% COMM., 10% IND., 33% OPEN	1950-1975	558	8,854	2,381	139	19
COYOTE-SILVER	PROTECTED (A)	141,183	NO CITIES STEEP TO MODERATE HILLSIDES ~100% OPEN	1950-1975	11	1,596	240	5	1
COYOTE-SILVER	DEVELOPABLE (B)	45,727	EVERGREEN ROLLING TO STEEP HILLSIDES 34% RES., 1% COMM., 1% IND., 64% OPEN	1950-1975	286	10,694	1,949	81	10
COYOTE-SILVER	URBAN (C)	39,269	MILPITAS, BERRYESSA, ALUM ROCK ALLUVIAL PLAIN, BAY SHORE AND MODERATE HILLS 40% RES., 9% COMM., 10% IND., 41% OPEN	1950-1975	435	8,262	2,022	110	15
LLAGAS-UVAS	PROTECTED (A)	66,095	NO CITIES STEEP TO MODERATE HILLSIDES 4% RES., 96% OPEN	1950-1975	70	8,217	1,254	30	4
LLAGAS-UVAS	DEVELOPABLE (B)	73,044	MORGAN HILL, SAN MARTIN, GILROY ALLUVIAL PLAIN AND ROLLING HILLS 16% RES., 1% COMM., 1% IND., 82% OPEN	1950-1975	385	22,796	3,825	126	17
ALAMEDA	PROTECTED (A)	141,293	NO CITIES STEEP HILLSIDES ~100% OPEN	1950-1975	250	37,229	5,589	124	19
PACHECO	PROTECTED (A)	106,924	NO CITIES STEEP HILLSIDES ~100% OPEN	1950-1975	189	28,173	4,229	94	14
COUNTY WIDE TOTAL		838,890			3,701	164,575	29,751	1,111	154

TABLE D-7. TOTAL ESTIMATED POLLUTANT LOAD DUE TO SURFACE RUNOFF, SANTA CLARA COUNTY, 2000

MAJOR WATERSHED NAME	SUB-AREA NAME	AREA (ACRES)	WATERSHED CHARACHTERISTICS (CITIES CONTAINED WITHIN, TOPOGRAPHY, LAND USES)	RAINFALL YEARS USED	ANNUAL POLLUTANT LOAD (1000'S OF LBS) BOD	SS	VSS	TOTAL N	TOTAL P
PALO ALTO-MT. VIEW	PROTECTED (A)	33,862	LOS ALTOS HILLS MODERATE TO STEEP HILLSIDES 30% RES., 1% COMM., .5% IND., 68.5% OPEN	1950-1975	339	13,983	2,489	98	13
PALO ALTO-MT. VIEW	URBAN (C)	33,034	PALO ALTO, MT. VIEW ALLUVIAL PLAIN AND BAY SHORE 45% RES., 13% COMM., 11% IND., 31% OPEN	1950-1975	398	6,195	1,676	99	13
SANTA CLARA, ET. AL.	PROTECTED (A)	2,022	NO CITIES STEEP HILLSIDES .1% RES., 99.9% OPEN	1950-1975	7	1,064	160	4	1
SANTA CLARA, ET. AL.	URBAN (C)	46,393	SUNNYVALE, CUPPERTINO, SANTA CLARA, SARATOGA ALLUVIAL PLAIN AND BAYSHORE 46% RES., 12% COMM., 13% IND., 29% OPEN	1950-1975	566	8,682	2,370	140	19
SAN JOSE SOUTHWEST	PROTECTED (A)	33,992	REDWOOD ESTATES, HOLY CITY STEEP HILLSIDES .3% RES., .2% IND., 99.5% OPEN	1950-1975	0	0	0	0	0
SAN JOSE SOUTHWEST	DEVELOPABLE (B)	29,474	NEW ALMADEN ALLUVIAL RIVER PLAIN AND MODERATE HILLSIDES 55% RES., 5% COMM., 3% IND., 37% OPEN	1950-1975	383	7,955	1,769	97	12
SAN JOSE SOUTHWEST	URBAN (C)	46,578	SAN JOSE, BURBANK, CAMPBELL CAMBRIAN PARK, LOS GATOS ALLUVIAL PLAIN, BAYSHORE AND MODERATE HILLS 43% RES., 16% COMM., 11% IND., 30% OPEN	1950-1975	588	8,871	2,461	146	20
COYOTE-SILVER	PROTECTED (A)	141,183	NO CITIES STEEP TO MODERATE HILLSIDES ~100% OPEN	1950-1975	11	1,596	240	5	1
COYOTE-SILVER	DEVELOPABLE (B)	45,727	EVERGREEN ROLLING TO STEEP HILLSIDES 41% RES., 1% COMM., 1% IND., 57% OPEN	1950-1975	329	10,391	1,974	89	11
COYOTE-SILVER	URBAN (C)	39,269	MILPITAS, BERRYESSA, ALUM ROCK ALLUVIAL PLAIN, BAY SHORE AND MODERATE HILLS 40% RES., 10% COMM., 12% IND., 38% OPEN	1950-1975	466	8,252	2,100	117	16
LLAGAS-UVAS	PROTECTED (A)	66,095	NO CITIES STEEP TO MODERATE HILLSIDES 14% RES., 86% OPEN	1950-1975	119	9,017	1,439	42	6
LLAGAS-UVAS	DEVELOPABLE (B)	73,044	MORGAN HILL, SAN MARTIN, GILROY ALLUVIAL PLAIN AND ROLLING HILLS 41% RES., 2% COMM., 1% IND., 56% OPEN	1950-1975	694	20,763	4,037	187	24
ALAMEDA	PROTECTED (A)	141,293	NO CITIES STEEP HILLSIDES ~100% OPEN	1950-1975	250	37,229	5,588	124	19
PACHECO	PROTECTED (A)	106,924	NO CITIES STEEP HILLSIDES ~100% OPEN	1950-1975	189	28,173	4,229	94	14
COUNTY WIDE TOTAL		838,890			4,339	162,171	30,532	1,242	169

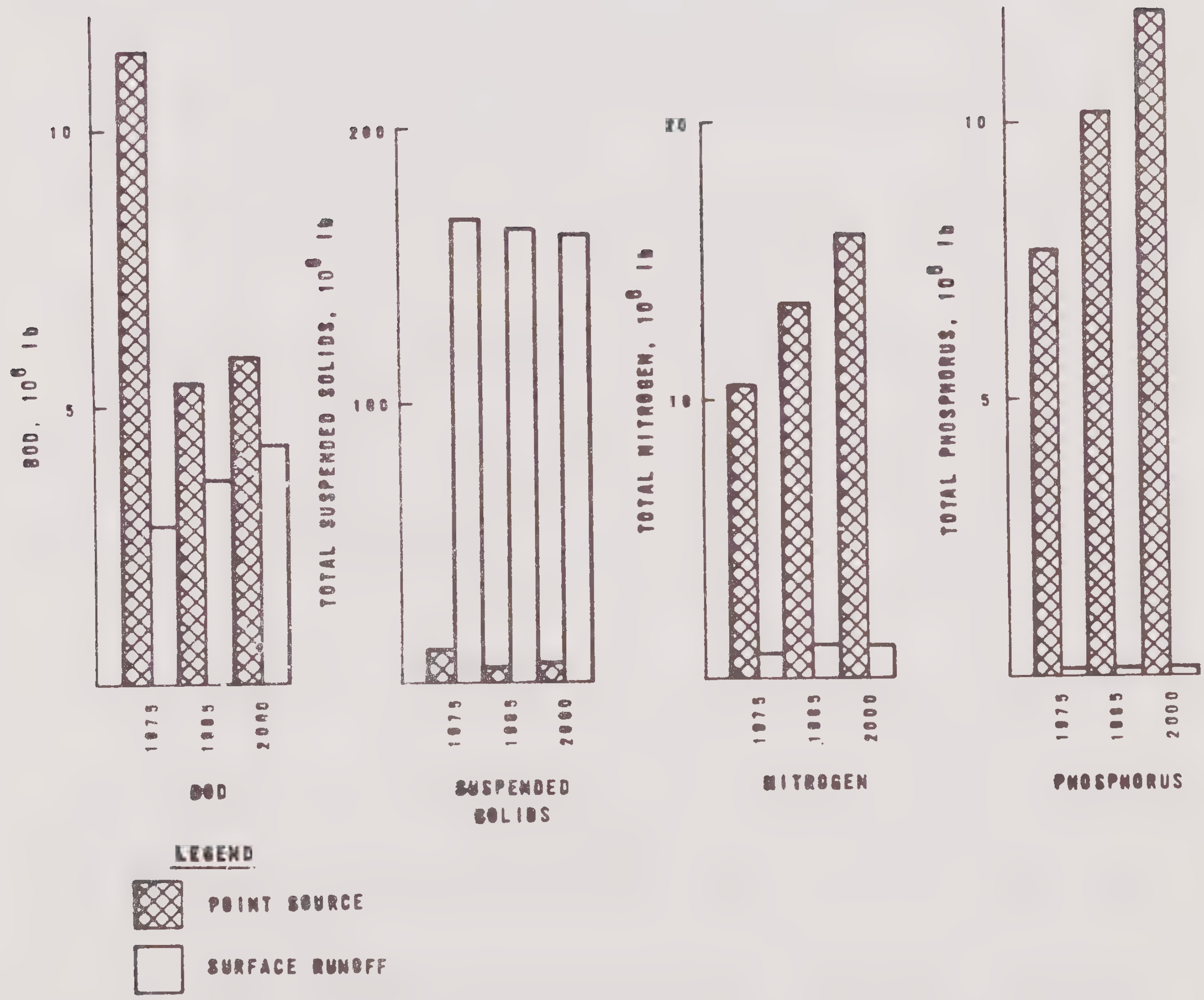


Figure D-2

COMPARISON OF POINT AND NONPOINT ANNUAL MASS LOADS

The constituents concentrations (on an annual basis) in the point source and surface runoff discharges are compared in Figure D-3. The results are similar to those for the mass load comparisons.

The comparisons of the various annual mass loads for the three subarea types (A = natural or protected, B = developable, and C = urbanized) for the years 1975, 1985, and 2000 are shown in Figures D-4, D-5, D-6, and D-7. Several things are apparent in reviewing these figures.

1. With the exception of total suspended solids, the annual mass load for each constituent increases slightly during each time period from 1975 to 2000 for each subarea category.

2. The major contribution of suspended solids and volatile suspended solids comes from the open or protected (A) areas.

3. For BOD_5, total nitrogen, total phosphorus, COD, oil and grease, cadmium, copper, zinc, and lead, the major annual mass load contribution comes from the urbanized areas.

4. For BOD_5, total nitrogen and total phosphorus, COD, and cadmium, the annual mass load in order of decreasing contribution is urbanized (C), open or protected (A), and developable (B).

Most of the annual mass load of suspended solids and volatile suspended solids comes from the open areas. In these areas, the hillsides are more susceptible to erosion. Erosion is the major source of the suspended solids in the surface runoff. The average concentration of the suspended solids in the surface runoff from the hillside areas is approximately 1,000 mg/L according to USGS records.

The annual mass loads for lead, cadmium, copper, zinc, COD, and oil and grease are projected to increase throughout the study period, as shown in Figures D-8 and D-9.

With the exception of suspended solids, the annual mass load increases during each time period in each subarea category. This is the result of increased development in each of the subarea categories. Development of open areas within each subarea category results in increased constituents concentrations in the surface runoff and, thus, increased annual loads.

The highest annual mass load contribution for BOD_5, total nitrogen, total phosphorus, heavy metals, COD, and oil and grease comes from the urbanized areas. This is to be expected since the concentration of these materials in the surface runoff is highest in these areas. However, the next greatest annual mass load contributor of these constituents is, generally, the open or protected areas. Even though their concentrations are lowest, the size of the open area (approximately 62% of the county) is sufficient to produce the mass load.

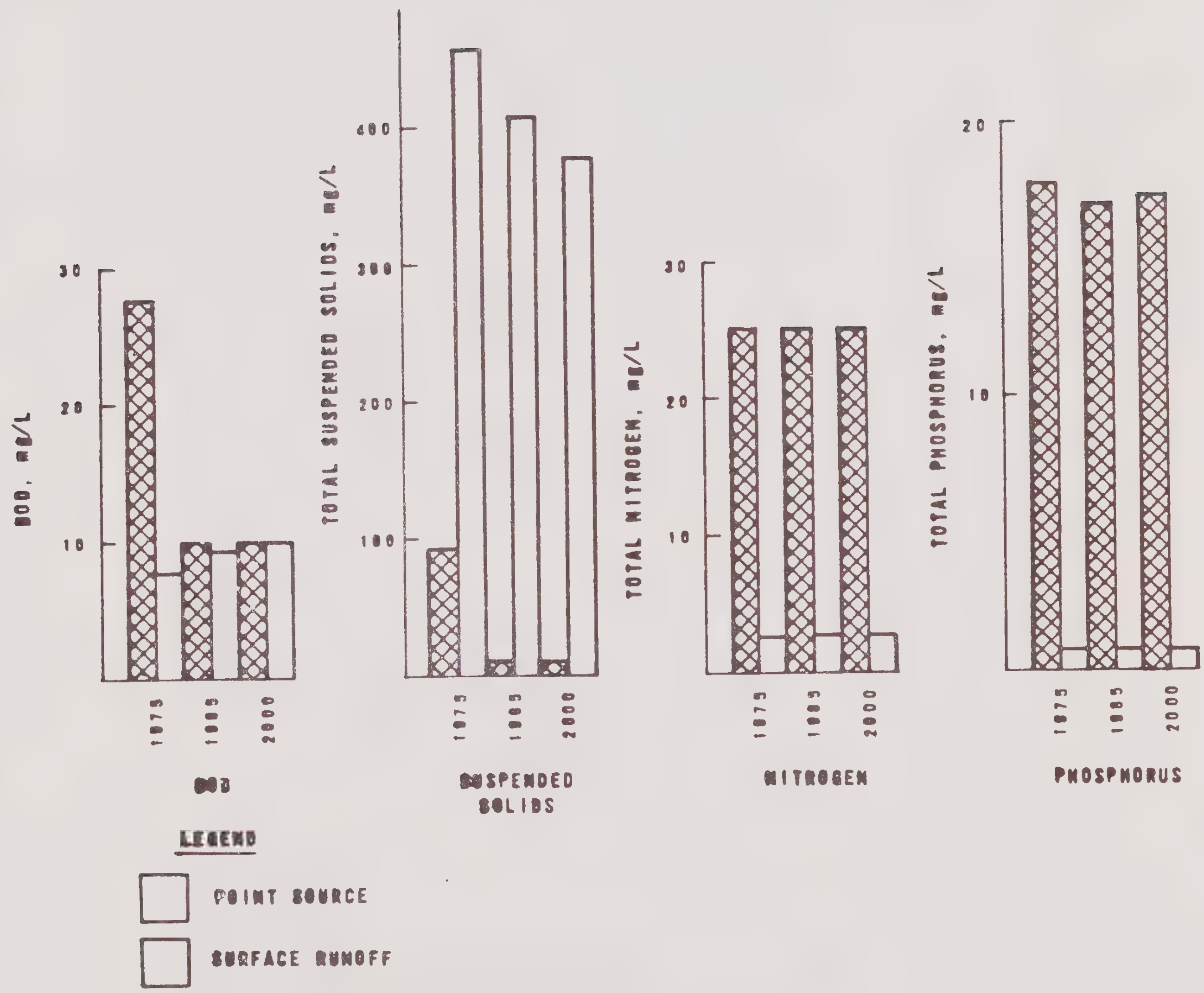


Figure D-3

COMPARISON OF SELECTED CONSTITUENTS CONCENTRATIONS
POINT SOURCE VS. NONPOINT SOURCE

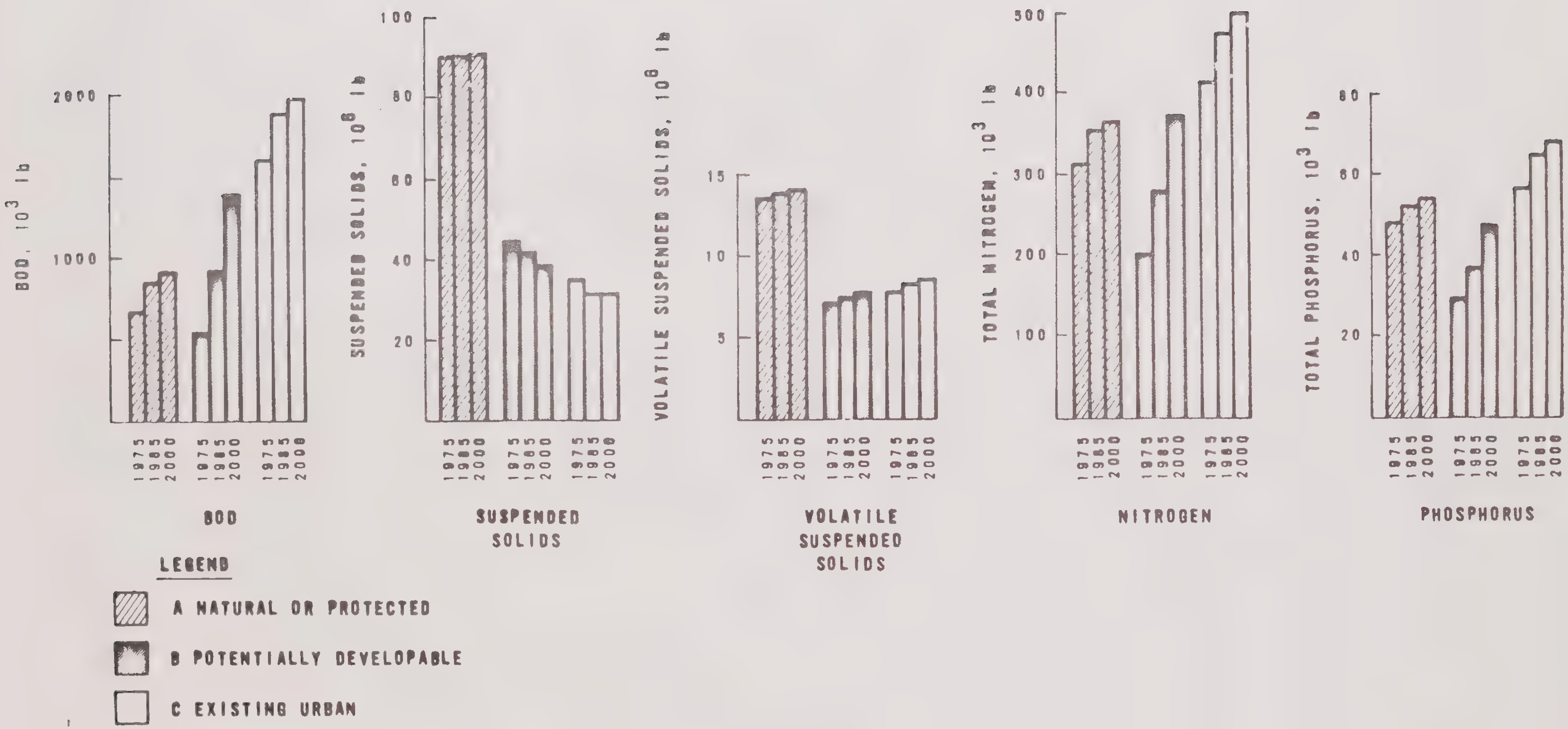


Figure D-4

COMPARISON OF ANNUAL MASS LOADS
FOR SELECTED CONSTITUENTS - 1975, 1985, AND 2000

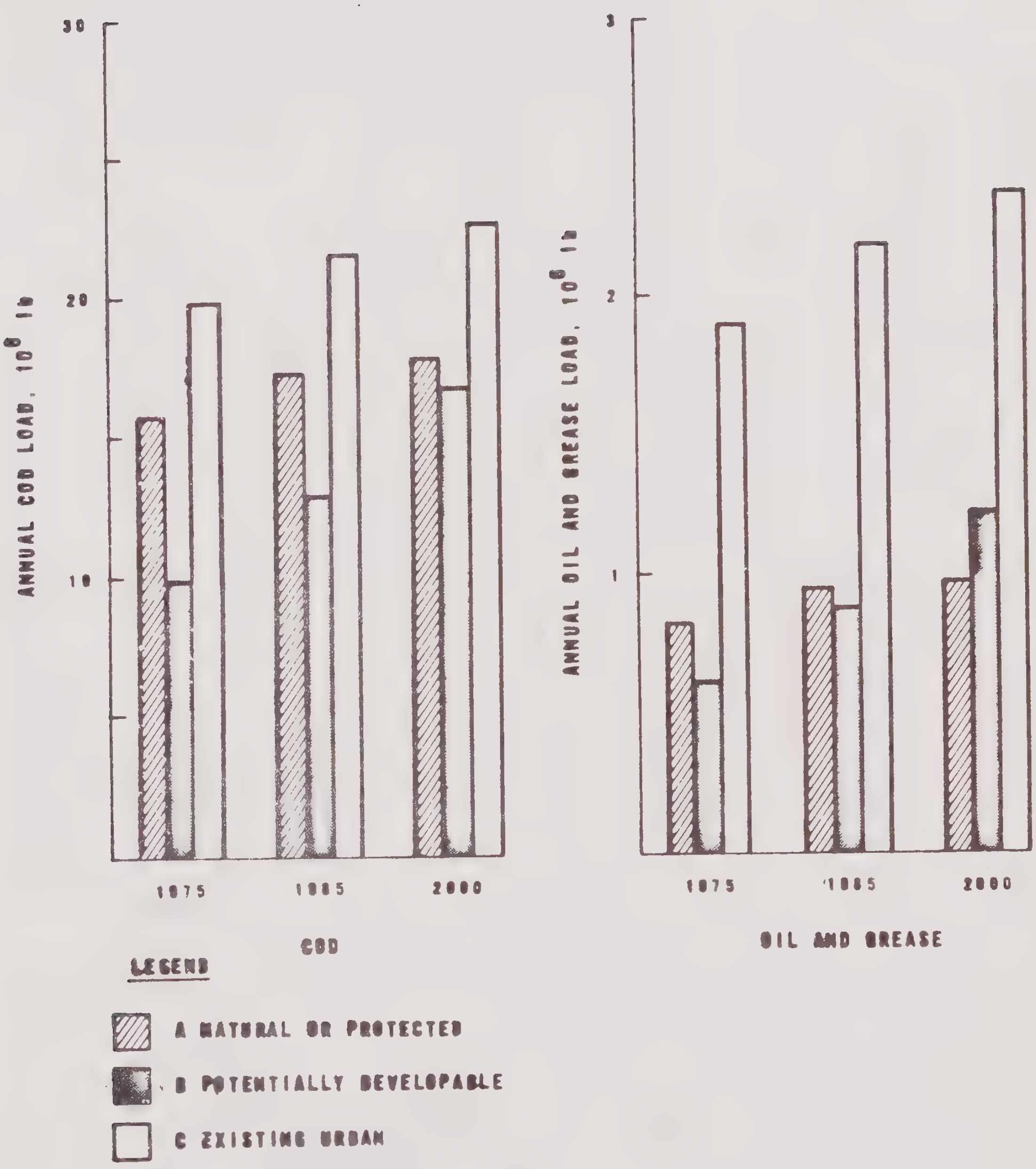


Figure D-5

PROJECTED LOADINGS OF SELECTED CONSTITUENTS
IN SURFACE RUNOFF MAC WATERSHEDS, SANTA CLARA COUNTY

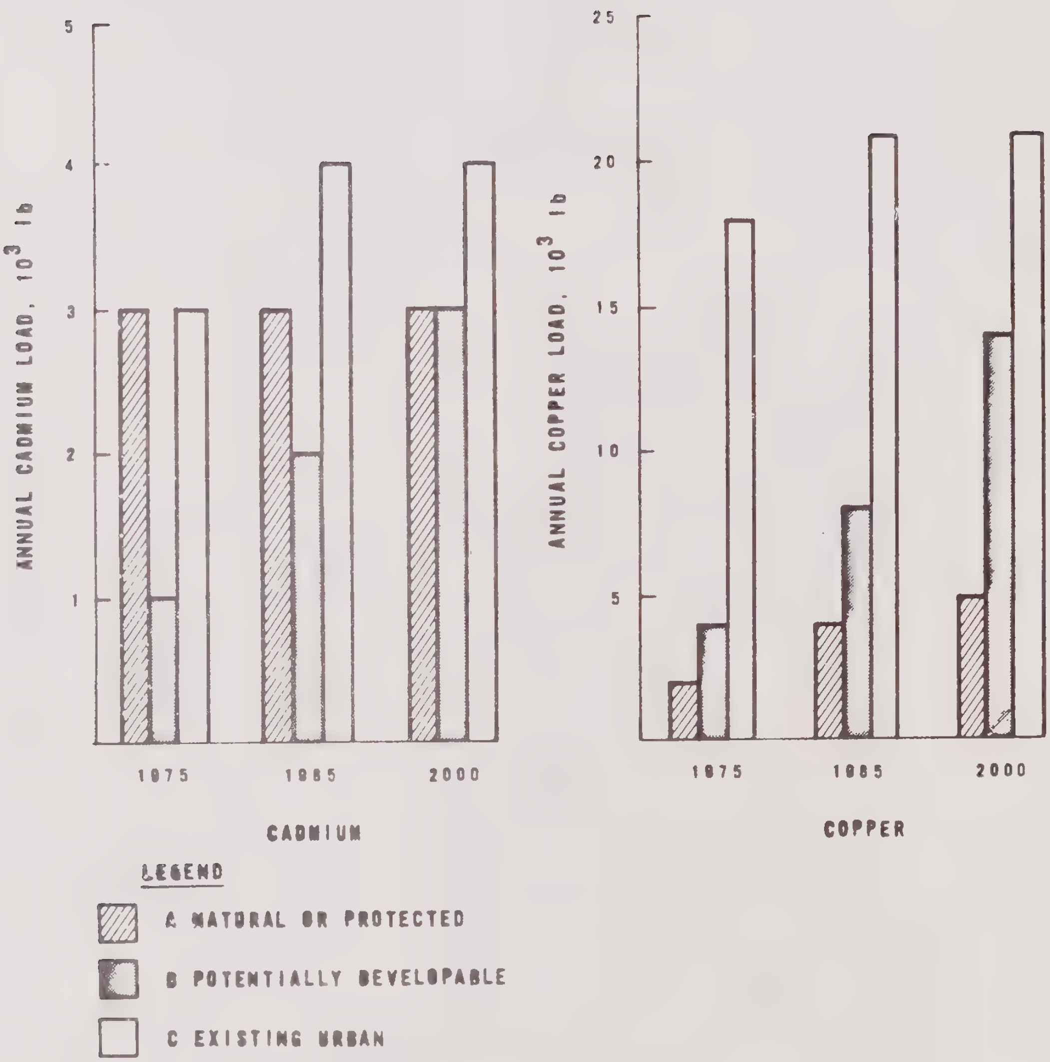


Figure D-6

PROJECTED LOADINGS OF SELECTED CONSTITUENTS
IN SURFACE RUNOFF MAC WATERSHEDS, SANTA CLARA COUNTY

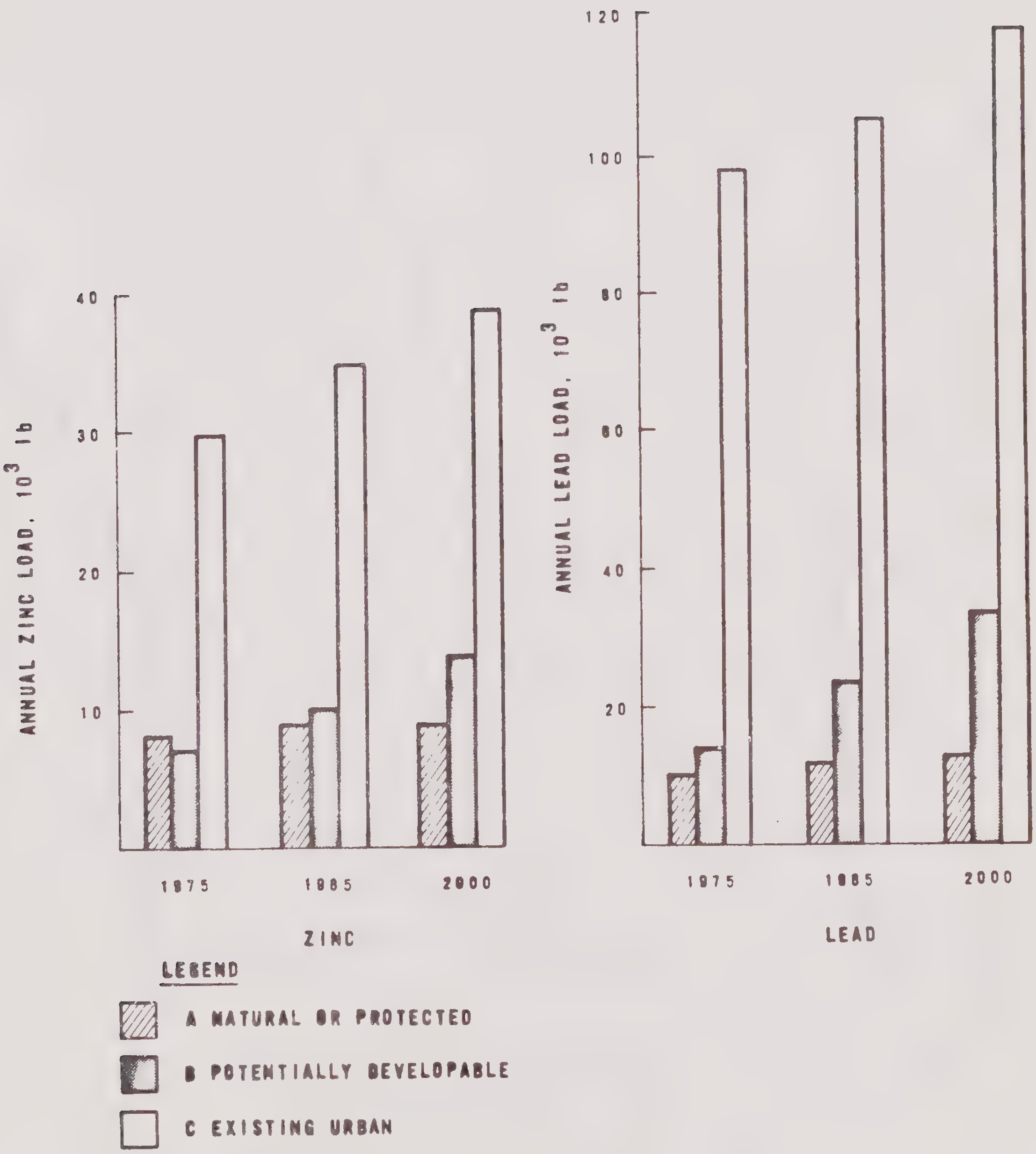


Figure D-7

PROJECTED LOADINGS OF SELECTED CONSTITUENTS
IN SURFACE RUNOFF MAC WATERHSEDS, SANTA CLARA COUNTY

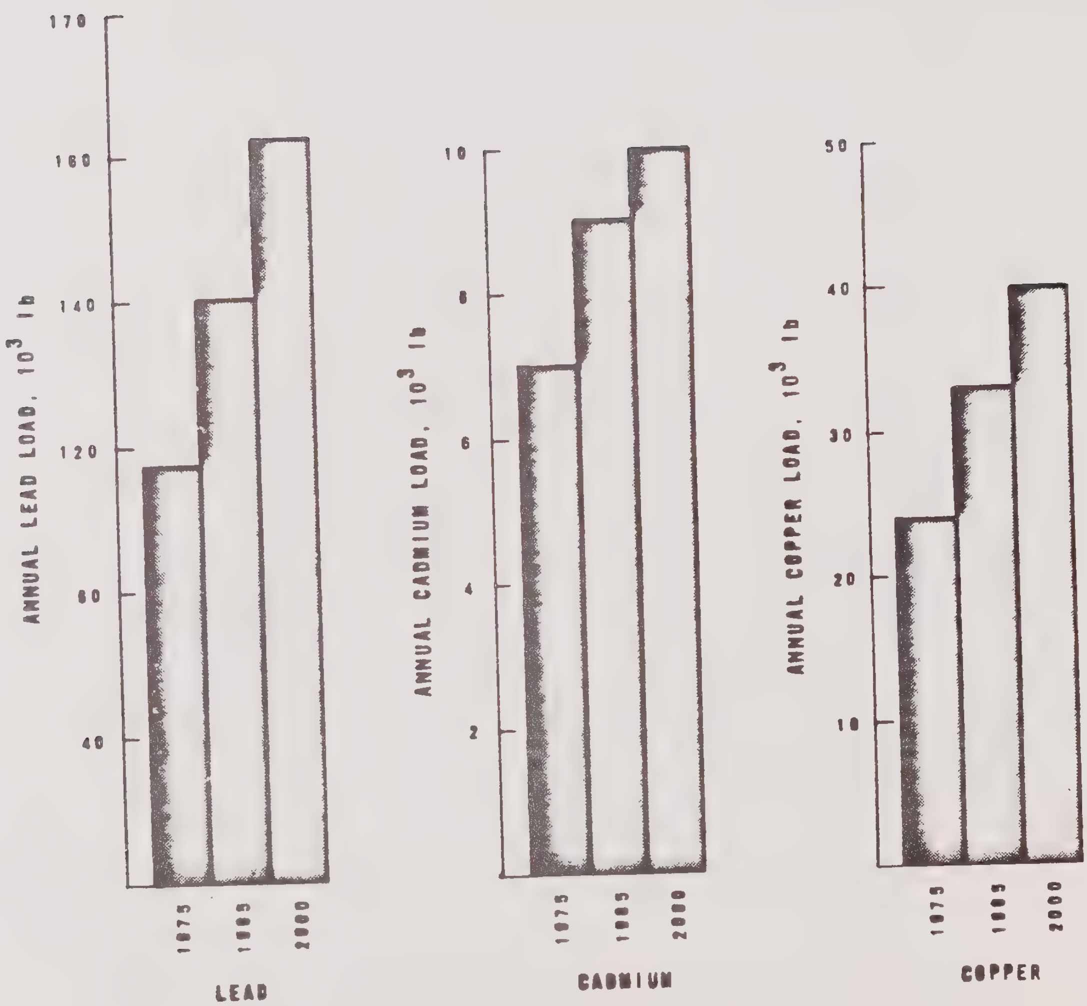


Figure D-8

PROJECTIONS OF MASS LOAD OF SELECTED CONSTITUENTS
IN STORMWATER, SANTA CLARA COUNTY

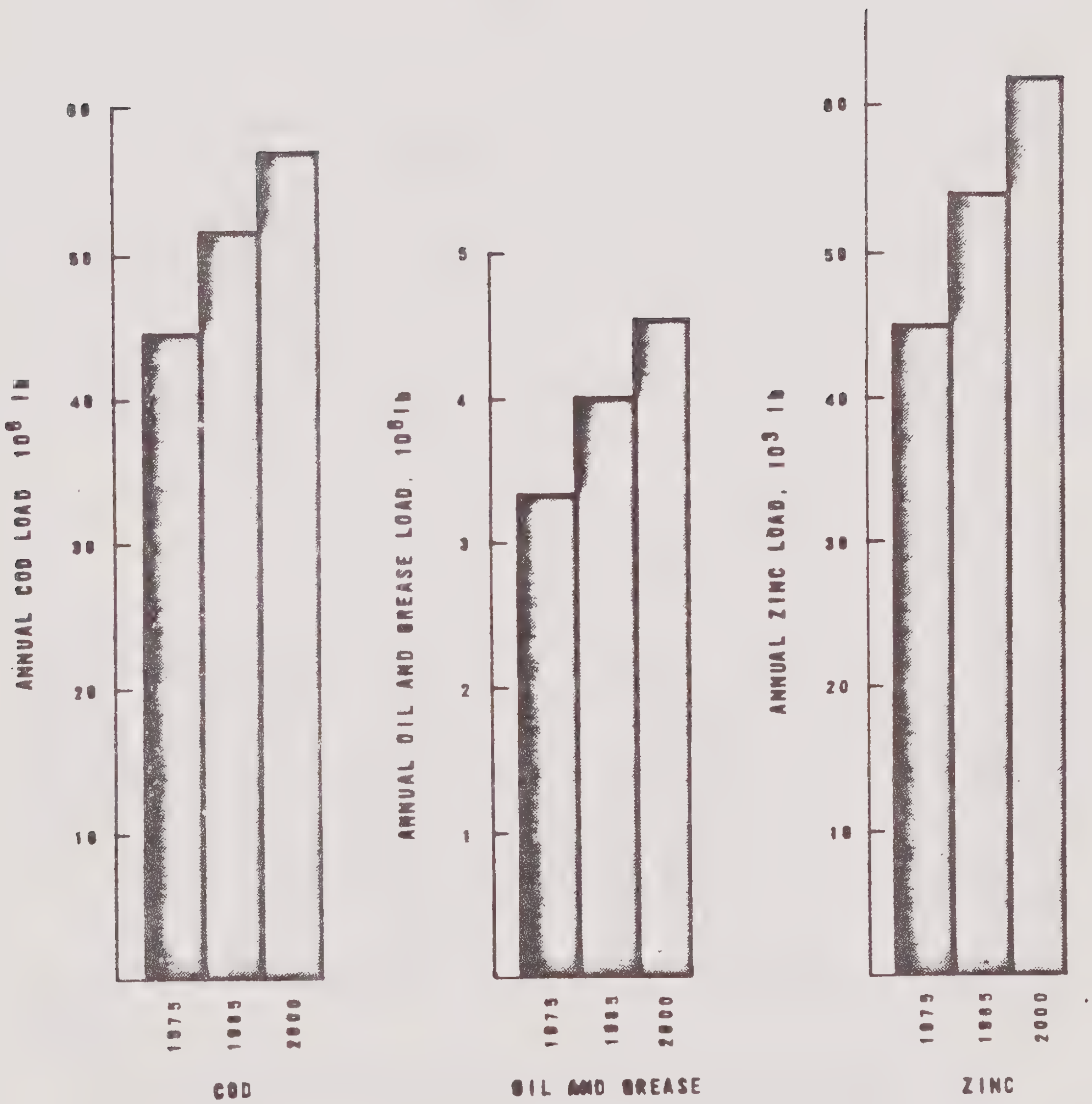


Figure D-9

PROJECTION OF MASS LOAD OF SELECTED CONSTITUENTS
IN STORMWATER, SANTA CLARA COUNTY

The comparison of the maximum monthly surface runoff loads with the average monthly municipal effluent loads is shown in Figure D-10. The BOD_5 and suspended solids loads for the maximum month surface runoff loads exceed the municipal effluent loads during the same period. Since the storm events occur over a short time period, when the events occur the mass load contribution is much greater than the municipal load. The result is a shock load on the receiving water. The magnitude of the shock load is dependent upon the individual storm event. Recent bay modeling work done for ABAG indicates the receiving water quality returns to pre-storm levels within approximately three days.

Ranking of Importance of Source Areas

The ranking of the subareas by annual mass load contribution is shown in Table D-8. For BOD_5, total nitrogen, and total phosphorus, the ranking generally begins with the largest urbanized area and progresses in order of decreasing urban subarea size and then progresses in the same way with the developable and open areas. For the solids loads, the opposite is true. The ranking begins with the largest open subareas and progresses into the developable and then the urbanized areas. The exceptions are the four open subareas that contain reservoirs. These are generally ranked lowest, as they pertained to the bay, since most of the sediments generated above them are retained in the reservoir and do not reach the bay without receiving the natural treatment provided by the reservoir.

The ranking of the subareas by unit mass load contribution (pounds per acre per year) is shown in Table D-9.

SWMM MODEL

The Storm Water Management Model (SWMM) is a comprehensive mathematical model, capable of representing stormwater runoff, developed to assist administrators and engineers in the planning, evaluation, and management of abatement alternatives. Hydrographs and pollutographs (time varying quality concentration or mass values) are generated for real storm events and systems. The level of detail used in the application depended on (1) the nature of the water quality problems being studied, (2) the types of control measures being considered, (3) the availability of input and calibration data, and (4) cost and manpower constraints.

Four steps are necessary in the application of SWMM for the surface runoff study:

- Problem definition and site description
- Data preparation
- Sensitivity analysis and model calibration
- Interpretation and generalization of results

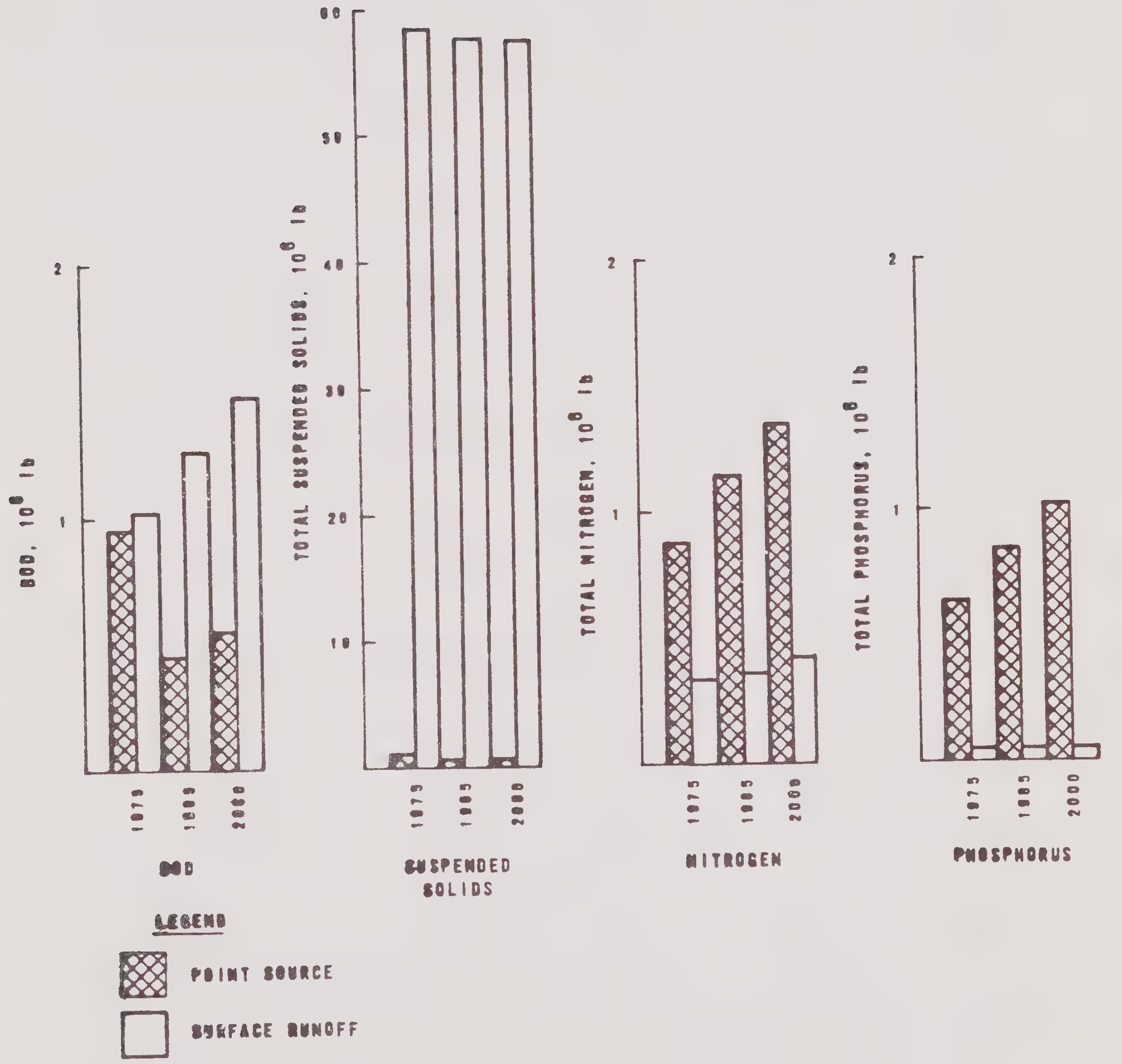


Figure D-10

COMPARISON BETWEEN SURFACE RUNOFF MASS LOAD (MAXIMUM MONTHS) AND MUNICIPAL EFFLUENT MASS LOAD (AVERAGE MONTH)

Table D-8. RANKING OF SUBAREAS BY ANNUAL MASS LOAD CONTRIBUTION
1,000 lb/yr

	BOD		SS		VSS		TN		TP	
Ranking	Location	Load	Location	Load	Location	Load	Location	Load	Location	Load
1	San Jose SW (C)	507	Alameda (A)	37,229	Alameda (A)	5,588	San Jose SW (C)	127	Alameda (A)	19
2	Santa Clara et al. (C)	450	Pacheco (A)	28,173	Pacheco (A)	4,229	Alameda (A)	124	San Jose SW (C)	17
3	Palo Alto-Mtn. View (C)	344	Llagas-Uvas (B)	23,887	Llagas-Uvas (B)	3,716	Santa Clara et al. (C)	115	Santa Clara et al. (C)	16
4	Coyote-Silver (C)	312	Palo Alto-Mtn. View (A)	14,630	Palo Alto-Mtn. View (A)	2,320	Pacheco (A)	94	Pacheco (A)	14
5	Alameda (A)	250	Coyote-Silver (B)	11,829	San Jose SW (C)	2,213	Llagas-Uvas (B)	93	Llagas-Uvas (B)	14
6	Llagas-Uvas (B)	222	Santa Clara et al. (C)	8,978	Santa Clara et al. (C)	2,155	Palo Alto-Mtn. View (C)	88	Palo Alto-Mtn. View (C)	12
7	San Jose SW (B)	204	San Jose SW (B)	8,923	Coyote-Silver (B)	1,851	Coyote-Silver (C)	84	Coyote-Silver (C)	12
8	Pacheco (A)	189	Coyote-Silver (C)	8,730	Coyote-Silver (C)	1,842	Palo Alto-Mtn. View (A)	63	Llagas-Uvas (A)	11
9	Palo Alto-Mtn. View (A)	161	San Jose SW (C)	8,365	Palo Alto-Mtn. View (C)	1,611	San Jose SW (B)	61	Palo Alto-Mtn View (A)	9
10	Coyote-Silver (B)	122	Llagas-Uvas (A)	7,815	San Jose SW (B)	1,602	Coyote-Silver (B)	49	San Jose SW (B)	8
11	Llagas-Uvas (A)	52	Palo Alto-Mtn. View (C)	6,451	Llagas-Uvas (A)	1,172	Llagas-Uvas (A)	26	Coyote-Silver (B)	7
12	Coyote-Silver (A)	11	Coyote-Silver (A)	1,595	Coyote-Silver (A)	239	Coyote-Silver (A)	5	Coyote-Silver (A)	1
13	Santa Clara et al. (A)	7	Santa Clara et al. (A)	1,064	Santa Clara et al. (A)	160	Santa Clara et al. (A)	4	Santa Clara et al. (A)	1
14	San Jose SW (A)	Ø	San Jose SW (A)	Ø	San Jose SW (S)	Ø	San Jose SW (S)	Ø	San Jose SW (S)	Ø

Table D-9. RANKING OF SUBAREAS BY UNIT LOADINGS
lb/acre/yr

	BOD		SS		VSS		Total M		Total P	
Ranking	Location	Load	Location	Load	Location	Load	Location	Load	Location	Load
1	San Jose SW (C)	10.84	Santa Clara et al. (A)	526.21	Santa Clara (A)	79.13	San Jose SW (C)	2.72	Santa Clara (A)	0.49
2	Palo Alto-Mtn. View (C)	10.41	Palo Alto-Mtn. View (A)	432.05	Palo Alto-Mtn. View (A)	68.51	Palo Alto-Mtn. View (C)	2.66	Palo Alto-Mtn. View (C)	0.36
3	Santa Clara et al. (C)	9.70	Llagas-Uvas (B)	327.08	San Jose SW (B)	54.35	Santa Clara (C)	2.48	San Jose SW (C)	0.36
4	Coyote-Silver (C)	7.95	San Jose SW (B)	302.74	Llagas-Uvas (B)	50.88	Coyote-Silver (C)	2.14	Santa Clara (C)	0.34
5	San Jose SW (B)	6.92	Alameda (A)	263.49	Palo Alto-Mtn. View (C)	48.77	San Jose SW (B)	2.07	Coyote-Silver (C)	0.31
6	Palo Alto-Mtn. View (A)	4.75	Pacheco (A)	263.49	San Jose-SW (C)	47.33	Santa Clara (A)	1.98	San Jose SW (B)	0.27
7	Santa Clara et al. (A)	3.46	Coyote-Silver (B)	258.69	Coyote-Silver (C)	46.91	Palo Alto-Mtn. View (A)	1.86	Palo Alto-Mtn. View (A)	0.27
8	Llagas-Uvas (B)	3.04	Coyote-Silver (C)	222.31	Santa Clara (C)	46.45	Llagas-Uvas (B)	1.27	Llagas-Uvas (B)	0.19
9	Coyote-Silver (B)	2.67	Palo Alto-Mtn. View (C)	195.28	Coyote-Silver (B)	40.48	Coyote-Silver (B)	1.07	Coyote-Silver (B)	0.15
10	Alameda (A)	1.77	Santa Clara et al. (C)	193.52	Alameda (A)	39.55	Alameda (A)	0.88	Llagas-Uvas (A)	0.17
11	Pacheco (A)	1.77	San Jose SW (C)	178.90	Pacheco (A)	39.55	Pacheco (a)	0.88	Alameda (A)	0.13
12	Llagas-Uvas (A)	0.79	Llagas-Uvas (A)	118.24	Llagas-Uvas (A)	17.73	Llagas-Uvas (A)	0.39	Pacheco (A)	0.13
13	Coyote-Silver (A)	0.13	Coyote-Silver (A)	11.30	Coyote-Silver (A)	1.69	Coyote-Silver (A)	0.04	Coyote-Silver (A)	0.01
14	San Jose SW (A)	0.00	San Jose SW (A)	0.00	San Jose SW (A)	0.00	San Jose SW (A)	0.00	San Jose SW (A)	0.00

Demonstration Watershed Selection

A demonstration watershed is "a watershed selected for detailed analysis." The main emphasis is the use of mathematical models for simulating surface runoff water quality to achieve the following objectives:

- Quantification of the extent and cause of existing water quality problems
- Estimation of the extent and cause of future pollution by surface runoff
- Assessment of the impact on water quality of instituting various control measures

The criteria for the selection of a demonstration watershed were suggested by ABAG [D-1]. For Santa Clara County, the selection criteria included:

- Watershed size
- Homogeneous land use
- Types of control measure to be tested
- Availability of stream flow data
- Suitability for water quality sampling program
- Geographical location

In September 1976, eight candidate watersheds were suggested. These watersheds were reviewed with an aerial reconnaissance flight, followed by field inspection of each watershed. Detailed watershed information is presented in Table D-10 and the analysis of advantages and disadvantages of each is presented in Table D-11. As a result of the analyses, Calabazas Creek was selected as the potential demonstration watershed and was presented to the Technical Advisory Committee in October 1976. It was the committee's consensus that more than one demonstration watershed be considered. San Martin Creek, with its small hillside drainage area and advanced urbanization on the valley floor, was selected as the second demonstration watershed. Berryessa Creek, with its location on the east side of the north valley and the on-going mixed type development activity was selected as a third demonstration watershed. Locations of these selected watersheds are shown in Figure D-11.

Table D-10. PRELIMINARY LIST OF CANDIDATE DEMONSTRATION WATERSHEDS

No.	County	Watershed name	General location	Physical features: Area, sq mi	Physical features: Major topographic characteristics	Physical features: Land use	Known problems and major dischargers	Beneficial uses	Hydrologic data: Rainfall	Hydrologic data: Streamflow	Hydrologic data: Water Quality	Developmental and other characteristics: Growth potential	Developmental and other characteristics: Jurisdiction with control measure implementation powers
1	Santa Clara	Matadero	Northwestern Santa Clara County near Page Mill Road between 280 and El Camino Real	6.2	Transition from hills to bay plain	Upper reaches - low density residential; middle - modern electronics industry and hospital complex; lower portions - medium density residential	Drainage of industrial areas	--	Several gages in vicinity, none specifically in area	One gage at El Camino	None	Filling in of low density residential	Palo Alto in lower reaches; Los Altos Hills in upper reaches
2	Santa Clara	Permanente	Between Grant Road and Miramonte Avenue in Mountain View	9.5	Transition between steep hills and valley floor	Undeveloped open upper portions; one industry along creek in hills. Residential area - low density changing to medium density	Industry (cement plant) is potential pollution source	--	Gages close to area	One gage at lower end	None	Filling in residential	Mountain View, County
3	Santa Clara	Calabazas	In Santa Clara and Cupertino in vicinity of De Anza College	10	Mostly flat valley floor	Almost exclusively medium density residential	Significant sedimentation	Percolation stream	Gages close to area	Two gages, one above and one below area	Some data on upstream areas	Filling in of residential areas	Santa Clara, Cupertino, San Jose, Sunnyvale Saratoga
4	Santa Clara	Saratoga	Adjacent to Saratoga Avenue	15	Mostly flat drainage - some upstream watershed drainage	Medium density residential changing to low density and open space	Some sedimentation	Percolation stream	Gage in area	One gage on downstream side	None	Filling of medium density residential; expansion of low density	San Jose, Saratoga, Santa Clara
5	Santa Clara	Sunnyvale East	Along Mathilda and Saratoga-Sunnyvale Road from 101 to 280	5.5	Valley floor	Well developed medium density residential; some higher density	Exclusively urban runoff	--	Gages adjacent and around area	None	None	Filling in and some increase in density	Sunnyvale and Cupertino
6	Santa Clara	Ross Creek	Between Blossom Hill, Capital Expressway, Highway 17 and 101	7.5	Valley floor	Residential	None	Percolation stream	Gages in vicinity	Gages both upstream and downstream of residential area	See page 9	Filling in of medium density residential	San Jose, County, Los Gatos
7	Santa Clara	Canoas	Drainage between Almaden Expressway and 101 to Capital Expressway	8.5	Valley floor	Medium density residential and agriculture-open space	Urban water only	--	Some gages within a few miles	None	None	Residential increase taking over agriculture	San Jose
8	Santa Clara	Berryessa	In Milpitas adjacent to Calaveras Road, behind Ford plant	14.5	Steep hills in transition to valley floor	Predominantly residential with agriculture in the uplands and some developing industrial areas	Sedimentation	Percolation stream	Gages in vicinity	One gage below development	None	Filling in of residential	Milpitas, San Jose

Table D-11. SUMMARY OF ADVANTAGES AND DISADVANTAGES OF VARIOUS DEMONSTRATION WATERSHEDS

Watershed	Advantages	Disadvantages
Matadero	• Good light industry • Good sampling and flow measuring facility	• Large drainage from low density residential area
Permanente	• Large heavy industrial plant • Good sampling and flow measuring facility	• Industry not representative of region • Large undeveloped draining to monitoring location
Calabazas	• Excellent homogeneous medium density residential • Good flow measuring and sampling points • Two gages, one above and one below area of interest • Existing sediment problem	
Sunnyvale East	• Exclusive storm drainage channel • Good residential and industrial land use	• No stream gage • Land uses are blended heavily
Ross Creek	• Good homogeneous residential area • Good flow measuring and sampling points • Two gages, one above and one below residential area	
Canoas	• Exclusive storm drainage channel • Good homogeneous residential	• No stream gage • Some large undeveloped tracts
Berryessa	• Homogeneous residential • Good flow measuring and sampling location	• Drainage from upstream hillside and grazing

Figure D-11

DEMONSTRATION WATERSHEDS

Input Data

Each demonstration watershed was divided into several "subcatchments" that had only one land use and were also hydrologically homogeneous. A drainage system was developed for the demonstration watershed with each subcatchment draining to a particular channel (either a natural channel or a storm drain). The channels were connected to form the required drainage network. Each subcatchment required the following data: area, ground slope, width, average overland flow distance, percentage of impervious area, land use, length of gutters, soil types, and area subject to erosion. Also required was information on each drainage channel section: length, invert slope, bottom width, side slopes, Manning coefficient, and depth when full. These data were obtained from maps, field observations, literature reviews, and interviews. Initially, national average quality data were used. After collecting sufficient local data during the sampling program, the national average data were replaced with the local data. Since SWMM must be applied on an individual storm basis, recorded rainfall data from nearby rain gages were used.

Drainage basin maps were prepared for each demonstration watershed. Individual overlays were prepared showing topography, land use, and the drainage channel and storm drain network. Subcatchments and the drainage network were then selected for each demonstration watershed SWMM simulation application. Examples of the drainage basin map and the subcatchment/drainage network map for the Calabazas Creek demonstration watershed are shown in Figures D-12 and D-13, respectively.

Calibration and Verification

The runoff block of SWMM is designed to simulate the response of small to medium-sized watersheds to individual storm events. The model consists of a fairly general computer program which can be tailored to specific urban or rural watersheds through adjustment of appropriate coefficients. Generally, coefficients are adjusted so that the model's predictions of flow or pollutant concentrations at an availaable monitoring site agree as closely as possible with observed values. This adjustment process, commonly known as model calibration, is normally a required part of any SWMM application. Calibration is necessary because coefficients such as surface detention depth, infiltration rate, dust and dirt generation rate, and even percent imperviousness are rarely known and they are difficult to measure directly in the field. It is best to infer these coefficients indirectly by adjusting them until the model's response matches that of the real world.

As might be expected, the coefficients which give good flow or pollutant predictions for a particular storm do not always give comparably good results under other conditions. Before confidence in the coefficients estimated during calibration can be established, the model must be tested on a series of storms to see if they provide uniformly good results. This model verification process gives a rough indication of the model's generality and overall accuracy.

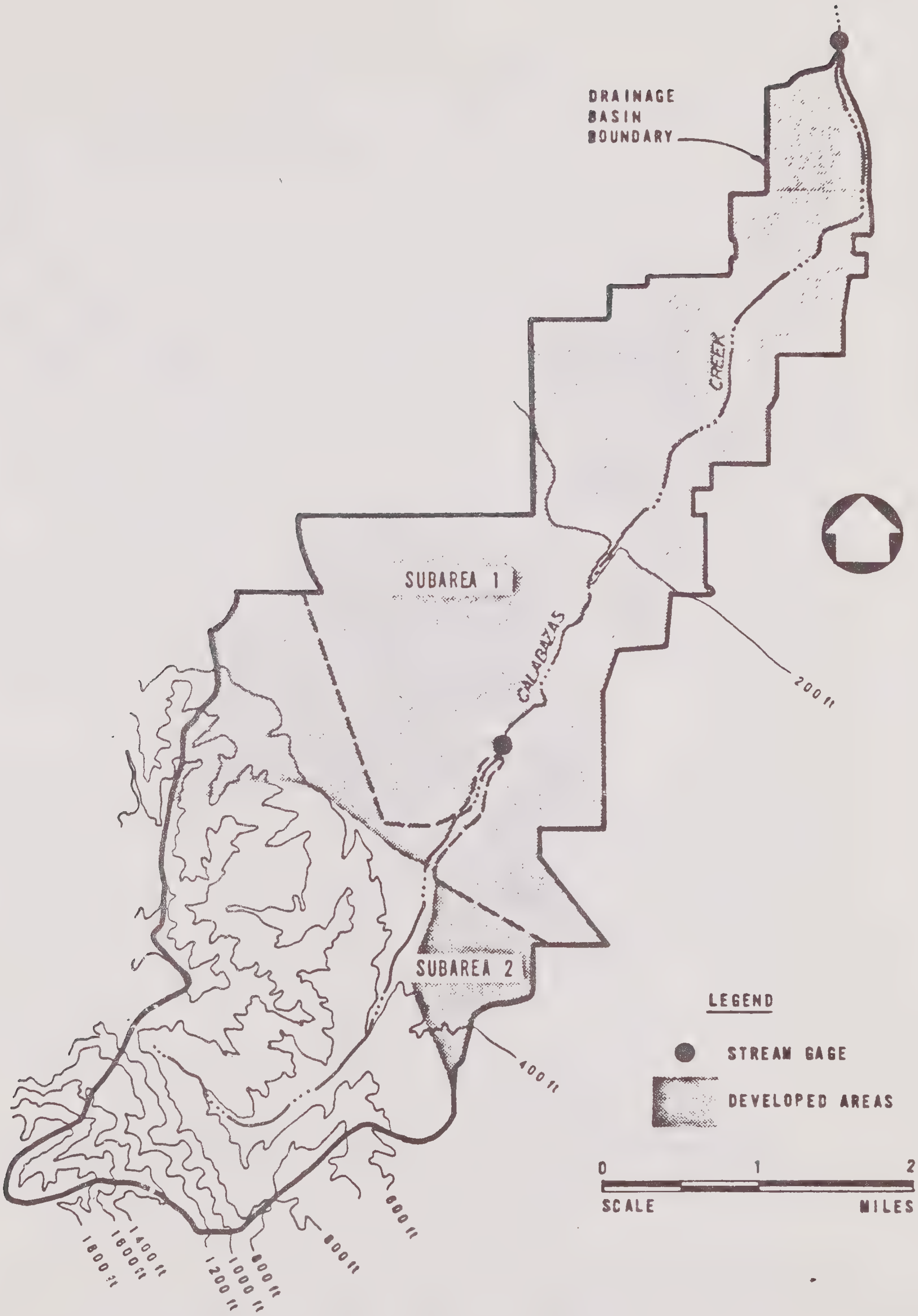


FIGURE D-12

CALABAZAS CREEK DRAINAGE BASIN

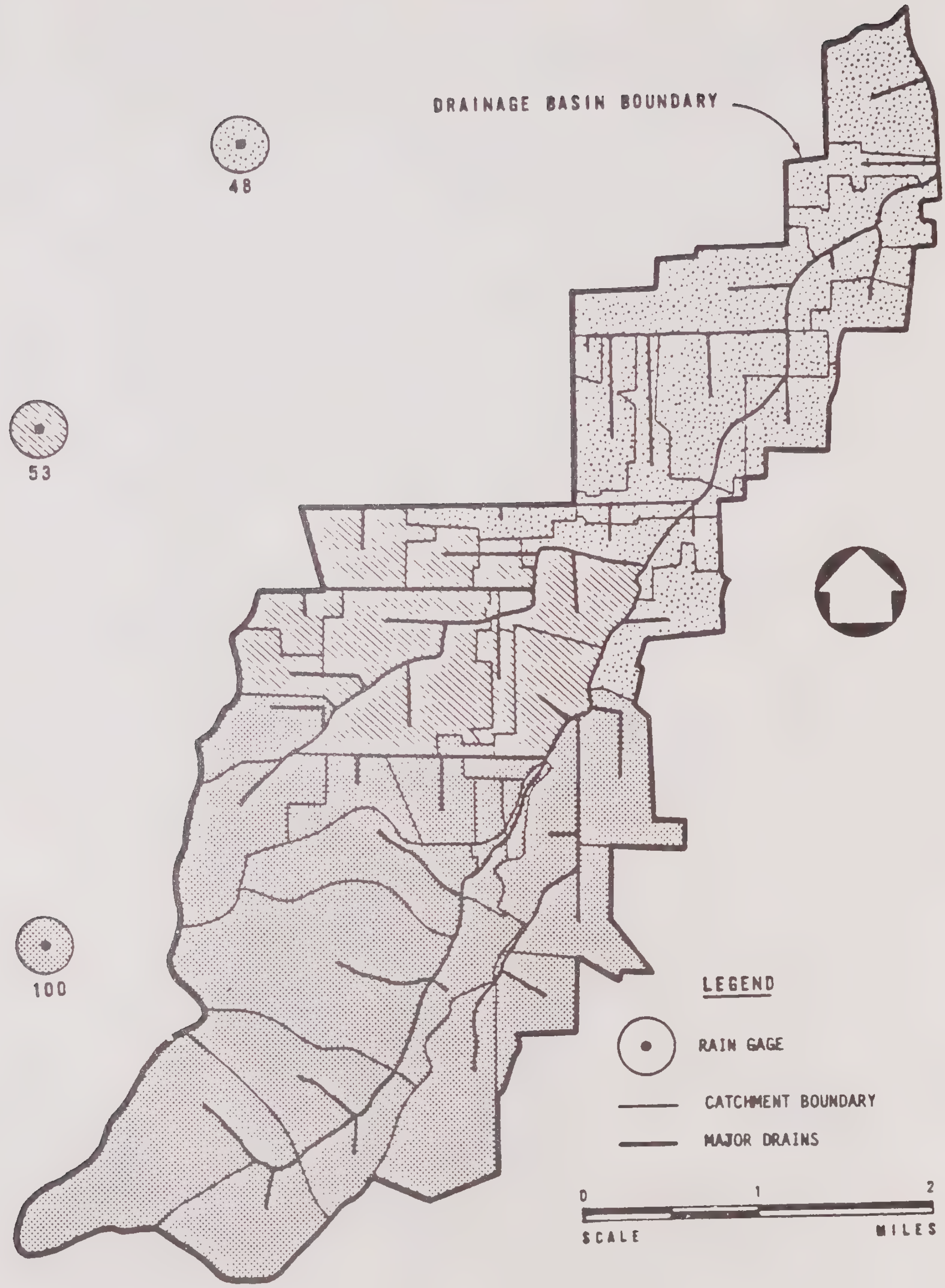


Figure D-13

SUBCATCHMENTS, DRAINAGE NETWORK, AND RAIN GAGE
ALLOCATIONS FOR SWMM SIMULATION, CALABZAZS CREEK DRAINAGE BASIN

The model was calibrated for the Calabazas Creek watershed using measured flow records from three storms for hydraulics (March 21, 1975; December 29-30, 1976; and January 2, 1977) and using the storm of December 29-30, 1976, for quality. An example of the results of the calibration runs is shown in Figure D-14.

SWMM Application

The lack of runoff from the San Martin Creek watershed prevented the collection of streamflow and quality data. Thus, no calibration or verification was possible. Historical quality data were not available for the Berryessa Creek watershed. The limited size and number of storms during the sampling period hindered the calibration and verification of the Berryessa watershed. As a result, emphasis was placed on calibration, verification, and use of the Calabazas watershed.

SWMM was used to determine the effect of various mitigation measures on the overall pollutant loads from the watershed. Mitigation measure success can be defined as the net reduction or reduced growth of an identified pollutant discharged. A net pollution reduction can be effected by (1) reducing or diverting the runoff volume (increasing opportunities for percolation into the ground); (2) reducing the storm pickup of pollutants (by better housekeeping, legislation, education--reduced sources; by reducing flowrates--check dams, vegetation; and by watershed management--erosion controls); and/or (3) treating a portion of the waste flow.

The extent that surface runoff management measures can be used to mitigate the pollutant load was simulated using SWMM. Once the magnitude of the reduction has been determined for a demonstration watershed, it can be extrapolated to the rest of the county by taking into account the land use distribution in each of the MAC watersheds. Thus, SWMM was used to estimate the effectiveness of a mitigation measure (determination of the change in concentration of the constituents in the runoff) and then the revised concentrations were used with MAC to determine the annual load from Santa Clara County.

SWMM-MAC APPLICATION

The procedures for determining the countywide impact of a control strategy are:

1. Select control strategy to be tested.

2. Adjust selected coefficients in SWMM program and initiate runs.

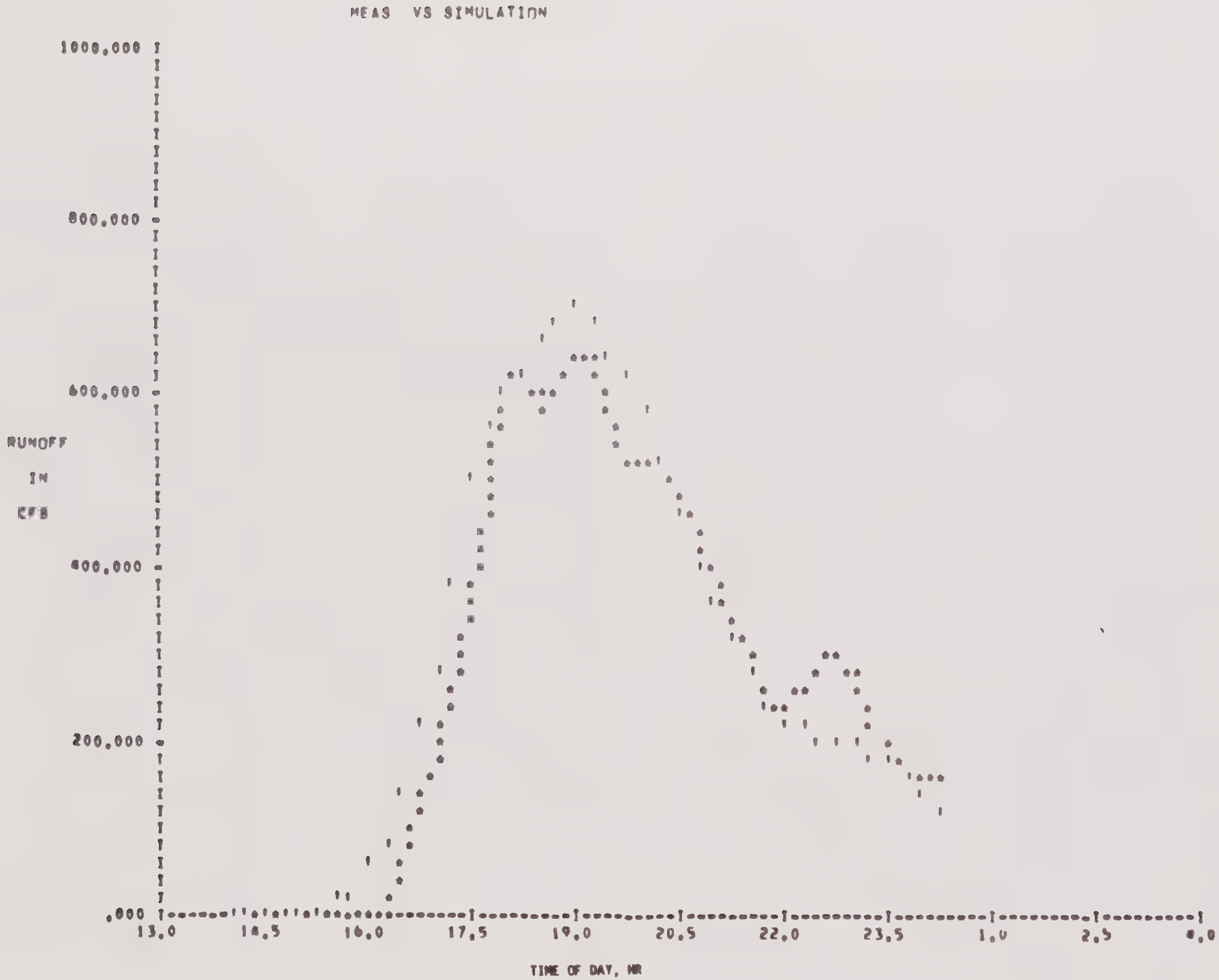


Figure D-14

MEASURED (') AND SIMULATED (*) FLOW FOR MARCH 21, 1975, STORM

3. Compute MAC coefficients based on SWMM runs or other specific source.

3. Specify runs that are to be made with MAC:

    - Existing conditions
    - Future conditions - 1985
    - Future conditions - 2000
    - Specific watershed affected

4. Enter coefficients into MAC Program and initiate runs.

5. Summarize output.

6. Draw conclusions concerning impact.

Model usage in any continuing surface runoff management planning process should include: (1) additional verification and calibration runs--concentrating on those areas and assumptions demonstrated to be most sensitive; (2) in the case of SWMM, extension to other watersheds; (3) as an aid in monitoring and assessing demonstration projects; (4) evaluations of new planning alternatives; and (5) upgrading of assessments as new data become available.

In applying the models it must be kept in mind that SWMM is weighted toward <u>design level</u> decisions whereas MAC is useful predominantly at the <u>concept level</u> and in the extrapolation of design level criteria to long-term impacts.

APPENDIX E

SURFACE RUNOFF MANAGEMENT CONTROL MEASURES

Appendix E

SURFACE RUNOFF MANAGEMENT CONTROL MEASURES

The process of urbanization brings about changes in the hydrologic cycle--expanding impervious areas and increasing runoff. Runoff flowing through the urban environment washes over materials that lie in its path. As a result, runoff entrains quantities of materials that eventually reach the receiving waters upon discharge. These materials can cause contamination or pollution if found in large enough quantities in sensitive areas.

To develop a plan to manage stormwater runoff that is relatively inexpensive, effective, and practical in application, the concept of Best Management Practices (BMP) has become the recommended approach of the Environmental Protection Agency (EPA) for all nonpoint sources. The following is a summary of available measures that have been used in the control and management of stormwater runoff.

When pollution caused by stormwater runoff becomes a problem, these control measures could be evaluated and a solution found by selecting the best alternative measure or combination of measures for the specific problem.

STORMWATER QUALITY MANAGEMENT PRACTICES

Management practices for stormwater quality control may be divided into two groups: preventive and corrective. Preventive measures are those that minimize either the quantity of peak runoff or the load of undesirable constituents. Corrective measures are the treatment methods that reduce loading from the stormwater runoff before discharge to the receiving waters.

A. Preventive Control Measures

Preventive control measures generally apply to control of both quantity and quality of runoff at the source, and are discussed in the following section.

1. Source Control-Flow.

Source control of stormwater flow can be accomplished by (1) proper land use planning and control, increasing the pervious areas and reducing surface runoff; and (2) use of detention facilities to modify the peak runoff rate.

1.1 Land Use Controls.

The transformation of undeveloped land to urban and suburban uses alters the natural hydrologic balance of the watershed. The degree of change and whether it is beneficial or detrimental depends on the mix, location, and distribution of the proposed land use activities. The usual result of the urbanization process is that the natural ground surface is replaced with roadways, parking lots, roofs, and other impervious areas. The net impact is increased runoff and decreased infiltration.

As far as stormwater is concerned, ideally a community's general plan would be prepared (or revised) so that proposed land uses conform to the natural (i.e., predevelopment) hydrological characteristics of the area as much as is practical. For example, high density, highly impervious land uses, such as shopping centers and industrial complexes, could be located in areas with naturally low infiltration potential, and the best recharge areas preserved as open, undisturbed space in parks and woodlands. Runoff from developed areas might be directed to other areas and detained to make the best use of any infiltration potential. Drainage channels on a selected basis, could be constructed like natural swales of the undeveloped site. Such broad, grassy swales would slow down the runoff and maximize infiltration.

Control of development patterns can include the following specific measures:

- Since earthwork and construction traffic compact the soil and decrease infiltration, as much area as possible should be left in a natural, undisturbed state or a certain percentage of the project area should be allocated as a pervious area.

- Slope-density standards can be promulgated. Steep slopes that would contribute to erosion and not to recharge, can be left as open space with adequate vegetative cover.

- Large expanses of impervious area might be avoided. For example, parking lots might be built in smaller units and drained to pervious areas. Buffer strips among impervious areas in new developments are another example.

- Development in flood plains could be restricted through zoning ordinances.

If natural drainage techniques are included in the development, the resulting system could provide a water balance more closely approximating the predevelopment conditions. It has been estimated that a natural drainage system may cost less per acre than a conventional system [E-1].

1.2 Detention Facilities

The objective of both detention and retention is either to prevent storm flow from reaching the drainage system or to change the timing of the runoff by controlling the release rate. Detention is the common term for delaying or controlling the release rate to smooth out the peak flows.

1.2a Source Ponding and Rate Control.

It has been suggested that roof tops in metropolitan areas might provide an opportunity for stormwater detention when they are flat, watertight, and structurally designed to take loads greater than that of ponded stormwater.

1.2b Roof Drains.

If roof downspouts discharge to the ground surface rather than directly to storm sewers as they do in some places, runoff would be detained in puddles as well as being subject to evaporation. The net infiltration into the sewer would be reduced and spread out over a period of time. The actual benefit depends on the roof area and rainfall intensity.

1.2c Inline Storage.

Because natural drainage ways can carry maximum flows occurring, say, once in 10 years, during most storms there will be considerable unused storage volume within the channel. Inline storage is provided by damming, gating, or otherwise restricting flow passage downstream with some regulator device. The additional storage is created by backing up the water in the upstream channels. Storm sewers with flat grades are essential to effective utilization of this concept. A controlled outlet would provide storage in the upstream drainage system. To avoid flooding, the restriction must be easily and automatically removed from the flow stream when critical flow levels are approached or exceeded. Problems associated with channel storage are the cleaning of the channel, removal of trapped sediment and debris, and the difficulty of implementing in urbanized areas without causing local flooding.

2. Source Control - Constituents

There are five types of constituent source control measures: (1) street cleaning. (2) drainage system maintenance, (3) septic tank/leach field maintenance, (4) erosion control, and (5) other measures requiring legislation.

2.1 Street Cleaning.

Street cleaning effectiveness is a function of (1) sweeping frequency, (2) number of passes, (3) forward speed of equipment, (4) equipment type, (5) extent of parked vehicles, and (6) pavement conditions.

Particle removal efficiencies of conventional street sweeping ranging from 11 to 62% of the initial solids loading have reen reported [E-2]. Overall removal has been estimated at 33% of all pollutants on the street surface [E-3].

Costs of street sweeping have been reported to range from $3.17 to $12.25 per curb mile swept (ENR 2000). The wide variation in these costs was attributed to differences in labor rates, unionization, and equipment costs [E-4].

2.1a Sweeping Frequency.

The relationship shown in Figure E-1 has been developed for materials normally found in urban stormwater and street sweeping frequency [E-3]. This curve shows that for frequencies of more than 20 days, sweeping has limited effect on BOD and suspended solids (SS) concentrations in stormwater. BOD and SS removals can be improved with more frequent sweeping; however, the trade-off between increased effectiveness and increased sweeping costs must be evaluated in order to obtain an optimum frequency.

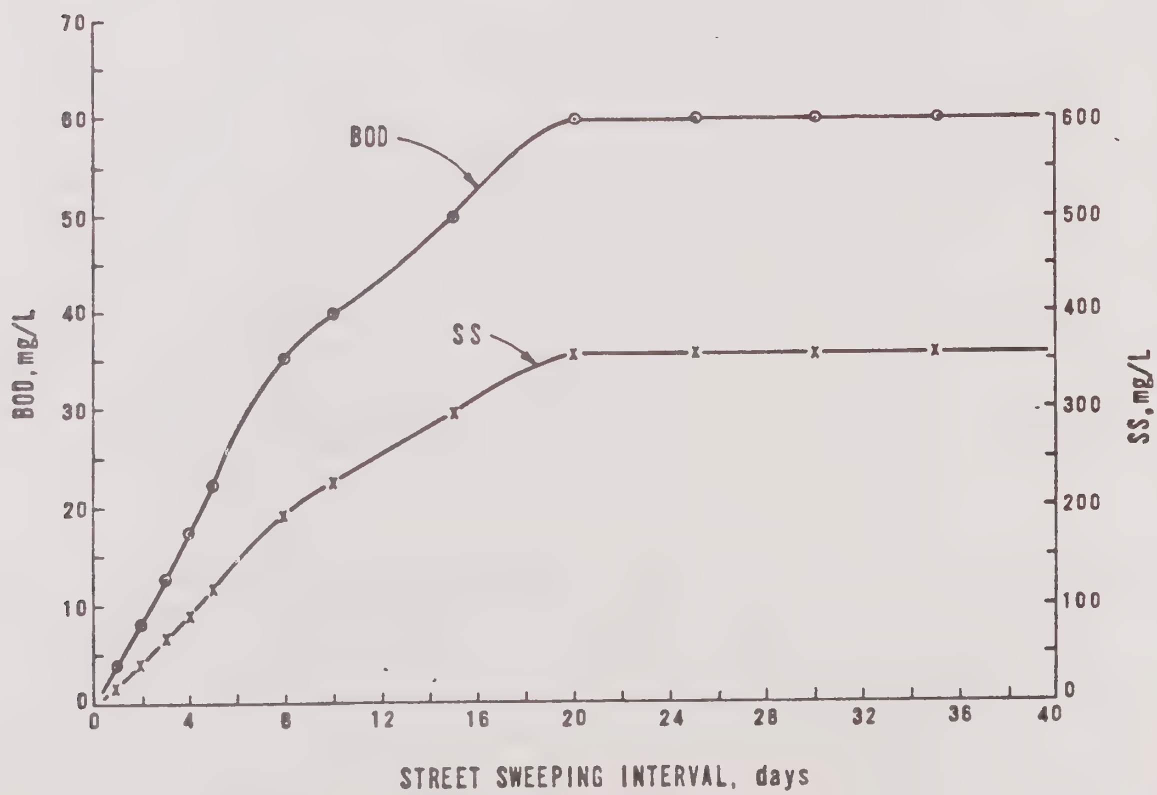


FIGURE E-1. EFFECT OF STREET SWEEPING FREQUENCY ON ANNUAL BOD CONCENTRATION IN URBAN STORMWATER RUNOFF, DES MOINES

2.1b Number of Passes.

Studies have also shown that the number of passes affects removal effectiveness [E-4], as shown in Figure E-2. The curve is based on an exponential relation between quantity of residual debris and initial debris load. The second and subsequent passes result in successively higher overall removal rates. However, the additional removal of the second and subsequent passes should be subject to a cost-effectiveness analysis.

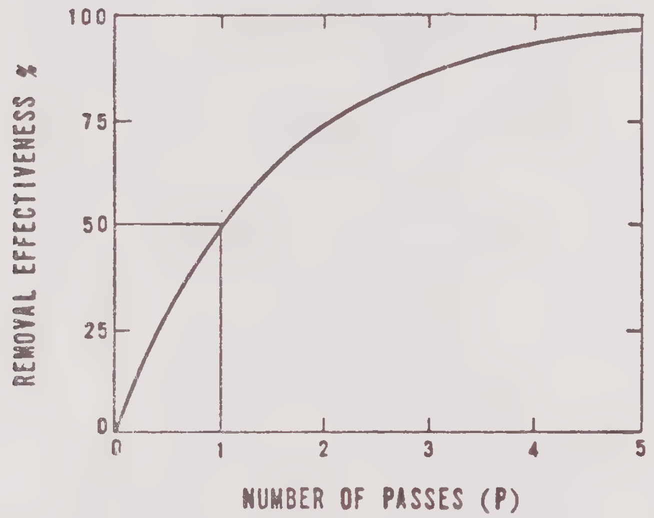


FIGURE E-2. REMOVAL EFFECTIVENESS WITH NUMBER OF PASSES

2.1c Forward Speed.

The effect of forward equipment speed has been evaluated on residual debris. The optimum forward speed appears to be within the range of 3.5 to 5.0 miles per hour for efficient removal [E-4].

2.1d Equipment Type.

There are three types of street cleaning equipment: (1) conventional (brush), (2) air blast, and (3) vacuum and flushing. Conventional sweepers are most efficient at removing larger sized debris but leave behind fine dust and dirt. Most stormwater contaminants are generally associated with these smaller sized street particles. Vacuum and air blast types are more effective in removing the smaller fractions; however, vacuum equipment rapidly loses its effectiveness when pavements are wet. This type of equipment is also subject to clogged air hoses and filters

from small sized particles [E-5]. Flushing can be used to remove street contaminants effectively; however, it may require more frequent drainage inlet and sewer cleaning. The comparative effectiveness of sweeping and flushing is shown in Figure E-3 [E-4].

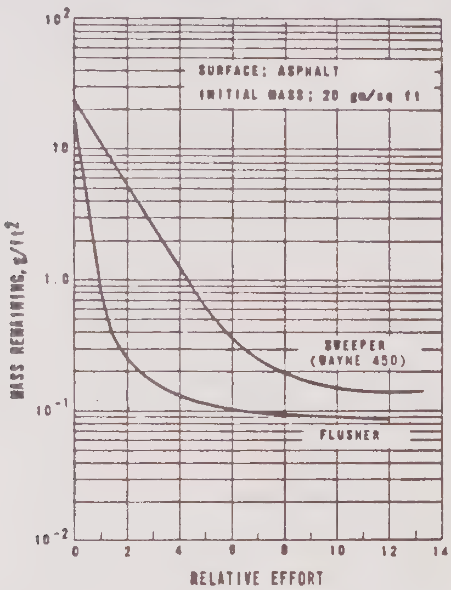


FIGURE E-3. COMPARISON OF CLEANING PERFORMANCES OF MOTORIZED STREET SWEEPING AND MOTORIZED STREET FLUSHING

2.1e Parked Vehicles

Deposits beneath parked vehicles are left untouched during sweeping operations. Parked vehicles could also be struck by sweepers during maneuvering. Parking restrictions are one method to improve this situation. Sweeping routes can also be designed to accommodate lifestyles and schedules of residents (i.e., when on-street parking is likely to be minimal). For example, business districts could be swept at night and residential areas during daylight hours.

3. Pavement Conditions.

Little data are available on how pavement conditions affect street sweeping. Debris lodged in potholes and cracks is usually beyond the reach of sweepers. As vehicles travel over these rougher streets, more particulate matter is shaken off. A large portion of the solids also come from broken chunks of the pavement [E-6].

It was reported that streets in "poor condition" had about twice the loading as streets in "excellent condition" (Figure E-4) [E-3]. Although ratings of conditions ("pavement serviceability index") were subjective, the results demonstrate that a street maintenance program can result in a significant reduction in accumulation of street material.

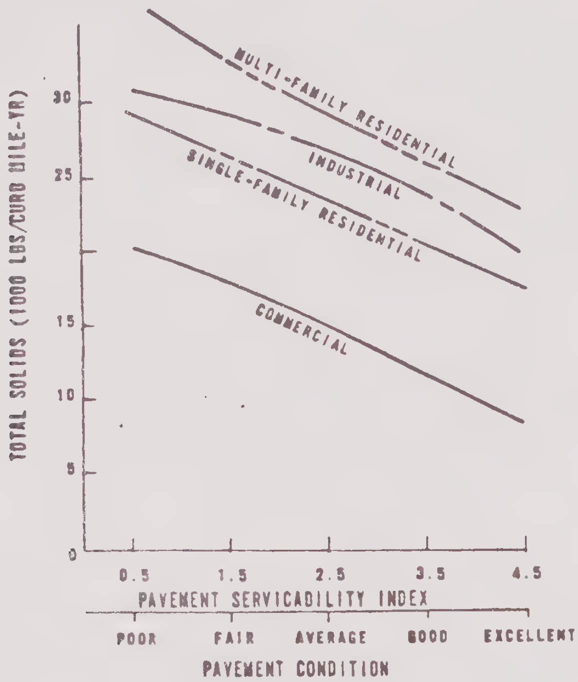


FIGURE E-4. EFFECTS OF PAVEMENT CONDITION AND SOLIDS LOADING

3.1 Drainage System Maintenance.

The major objective of drainage system maintenance is to remove potential contaminants from stormwater drainage systems prior to rainfall and to minimize the loads discharged to the receiving waters. Major tasks involve the maintenance of natural drainage ways and the cleaning of inlets.

3.2 Drainage Channel Maintenance.

Maintenance of drainage and flood channels can include such tasks as trash and debris removal, weed control, and silt removal. Silt removal is often a problem in specific areas of a flood control system. Erosion of banks poses an equally serious problem in other areas of the same system. Both problems must be addressed on a case-by-case basis and can generally be avoided with proper care in the design of the channels that are used.

Currently, limited cost data are available on the maintenance of flood control channels. A limited survey of west coast flood control districts indicates that the cost for maintenance of flood control facilities ranges from $0.75 to 1.75 per linear foot of facility. This cost would be affected by the size of channel, the type of channel lining, and the access to the channel.

Both the Santa Clara Valley Water District and the Corps of Engineers have developed cost information for maintenance of flood control facilities based on their experiences. These costs are summarized in Tables E-1 and E-2.

Table E-1. MAINTENANCE COSTS FOR FLOOD CONTROL FACILITIES SANTA CLARA VALLEY WATER DISTRICT, 1977

Description	Cost[a] $/mile/yr
Modified Flood Plain (300 ft R/W)	12,000
Earth channel	20,000
Rock channel	15,000
Concrete trapezoidal channel	5,000
Concrete rectangular channel	3,000
Box culvert	500
Pipe	500

a. Costs are subject to many variables, may vary significantly in actual practice.

Table E-2. MAINTENANCE COSTS FOR FLOOD CONTROL FACILITIES, CORPS OF ENGINEERS

Item	Factor, yearly costs
Concrete structures	0.1% of first cost
Gates and steel structures	1.5% of first cost
Levees	$960 + $16/ft height-per-mile
Riprap slopes	$70/ft height-per-mile
Unlined slopes	$144/ft height-per-mile
Channel	$320 per mile
Roads and berms	$400 per mile
Interior drainage facilities	2% of first cost
Undevelopment riverbanks	150% of developed bank cost

4. <u>Septic Tank/Leach Field Maintenance</u>.

The basic idea behind a septic tank/leach field maintenance program is regular inspection of tanks and disposal fields, and required pumping on a periodic basis (usually every 2 to 3 years). Regular inspection is the best way to determine if pumping is required. If a septic tank is not pumped, the sludge buildup could reach the tank outlet. Solids accumulation in the leach field could then result in soil clogging and failure of the system (i.e., overflow to the ground surface or backflow into house plumbing). Successful inspection and preventive maintenance would minimize these problems.

The key elements in a preventive maintenance program are regular inspections and the authority to enforce the correction of failed systems. The success of such a program depends on the cooperation of septic tank owners, as well as the capability of the administering agency.

A number of California communities have or are considering establishing such programs. Among those currently operating are those in Santa Cruz County, Marin County, and the Georgetown Divide Public Utility District in El Dorado County.

There would be some administrative costs associated with the program. Septic tank owners could also be required to bear the cost of routine inspection, pumping, and rehabilitation of failed systems. The actual dollar amounts depend on how the program is administered. For example, the Georgetown program involves issuing permits for new septic tanks, semiannual inspections, and a water quality monitoring program. These activities have required 1-1/2 full-time employees. The annual budget is $32,000, of which two-thirds is raised by a $1 per month per lot levy. The community consists of 1,800 lots on 3,000 acres of which 130 currently are developed and have septic tanks. In Marin County, 450 septic tanks installed since 1972 are included in the inspection program. Biennial inspection is required with one full-time health officer covering the entire county.

5. <u>Erosion Control</u>.

Control of erosion from natural watersheds as well as from construction sites can have an impact on the total amount of material that is imposed on receiving waters. As Santa Clara County has extensive agricultural activity, a considerable amount of land is exposed to erosion.

The Soil Conservation Service (SCS) developed an equation for predicting the annual average soil loss from agricultural land. This equation has been modified to predict the short-term losses from single storm events

and for uses related to construction sites. The universal soil loss equation is as follows [E-7]:

$$E = R{:}\ K{:}\ LS{:}\ C{:}\ P$$

where E = total sediment loss, tons/acre/yr
R = rainfall factor
K = erodibility factor
LS = slope length factor
C = vegetative cover factor
P = erosion control procedure factor

The rainfall factor, R, ranges from 15 to 50 for Santa Clara County. The soil erodibility factor is a function of soil properties, specifically percent silt and very fine sand, percent sand, organic content, soil structure, and permeability. This variable has a typical range from 0.15 to 0.50 for common soils. A value of 0.35 is typical for good agricultural land.

The slope length factor is a function of topography and can be determined by the following equation:

$$LS = L^{1/2}\ (0.0076 + 0.0053S + 0.00076S^2)$$

where L = length from the point of origin of overland flow to the point where the slope decreases to the extent that deposition begins or to the point at which runoff enters a defined channel, ft

S = the average percent slope over the given runoff length

The vegetative cover factor is dependent on the type of ground cover, general management practice, and the condition of the soil. The erosion control factor reflects the effectiveness of any existing erosion control practice. Typical values are summarized in Table E-3.

On the basis of the aforementioned factors, several basic principles for control of erosion are possible:

- Reduce the area and duration of soil exposure.
- Protect the soil with mulch and vegetative cover.
- Reduce the rate and volume of runoff by increasing infiltration rates and surface storage and by planned diversion of excess runoff.
- Diminish runoff velocity with planned engineering work.
- Protect and modify drainage ways to withstand concentrated runoff resulting from paved areas.

- Trap as much sediment as possible in temporary or permanent sedimentation basins.

- Maintain completed works and assure frequent inspection for maintenance needs.

These principles can be implemented by a variety of measures. Detailed descriptions and design criteria are available in the literature [E-8, E-9].

Table E-3. EROSION CONTROL PRACTICE FACTOR P FOR CONSTRUCTION SITES [E-7]

	Factor P
Surface condition with no cover	
1. Compact, smooth, scraped with bulldozer or scraper up and down hill	1.30
2. Same as No. 1, except raked with bulldozer, root raked up and down hill	1.20
3. Compact, smooth, scraped with bulldozer or scraper across slope	1.20
4. Same as No. 3, except raked with bulldozer, root raked across slope	0.90
5. Loose as a disked ploy layer	1.00
6. Rough irregular surface, equipment tracks in all directions	0.90
7. Loose with rough surface greater than 12-in. depth	0.80
8. Loose with smooth surface greater than 12-in. depth	0.90
Structures	
1. Small sediment basins	
0.04 basin/acre	0.50
0.06 basin/acre	0.30
2. Downstream sediment basins	
With chemical flocculants	0.10
Without chemical flocculants	0.20
3. Erosion control structures	
Normal rate usage	0.50
High rate usage	0.40
4. Strip building	0.75

The costs of some of the control alternatives are presented in Table E-4.

Table E-4. ESTIMATED EROSION CONTROL COSTS [E-10, E-11]

Measure	Initial placement cost, \$/acre	First year maintenance cost, \$/acre
Vegetative		
Seeding: seedbed preparation, seed and application, mulching at 2 tons/acre		
Temporary seeding by machine	240-330	50-120
Temporary seeding by hand	335-415	50-120
Permanent seeding by machine	790-1,220	50-120
Sodding, including seedbed preparation	2,400-3,600	240-2,900
Mulch, 2 tons/acre		
By hand	120-140	--
By machine	90-120	--
Mechanical		
Earth diversion berms	0.15-0.30	1.20-3.60
Straw bale barriers	0.75-1.10	1.20-3.60
Silt basins with earth dam, watershed area, acres		
2 to 5	600-1,200	500-750
25 to 100	1,200-3,500	750-1,200
100 to 200	3,500-5,000	1,200-1,800
Sodded ditches	4.50[a]	--
Graded stabilization structure	2.80[a]	--
Level spreader	2.80[a]	--

a. \$/linear foot.

The effectiveness of the selected alternative might be checked by computing the erosion load based on the universal soil loss equation using new factors that reflect the selected control strategy and comparing it with the erosion load computed on the basis of the original conditions.

6. Legislation.

Special legislation may be necessary to implement some best management practices effectively. Laws, ordinances, and agreements are the usual vehicles. The alternative, civil suits and tort law, becomes almost unworkable when thousands of property owners are involved. The simplest

form of legislation, and the form enacted in most urban areas, provides for a public works authority to build and maintain a drainage system to transport runoff to a major receiving water streams.

Legislation can take any of several forms depending on the authority and objectives of the legislative body. Examples would include county and city ordinances, flood control ordinances, building codes, zoning plans, subdivision regulations, sewer and drainage fee assessments, greenway or open space plans, and pollution control ordinances.

A summary of innovative programs as reported in the literature [E-12] is presented in Table E-5. The following outline covers many of the recommended points.

1. Scope. The ordinance is referenced to existing legislation to prevent overlap or conflict.

2. Definitions. Engineering terms and concepts used in the ordinance should be clarified.

3. Objectives. This section is used to give direction to ordinance and to help the citizenry and courts understand the purposes of the law. Several objectives were listed earlier.

4. Floodplain Regulation. Develops regulations for land use within the contours of the 100 year flood.

5. Hydrologic and Hydraulic Studies. Developers submit runoff studies for a proposed project. The reports contain details of existing and projected runoff volumes and rates to serve as a basis for designing detention facilities and measuring potential impacts on downstream systems.

6. Improvements Required. Depending on the objectives of the ordinance, improvements may be required to meet runoff standards. Detention facilities could be required and a maximum release rate specified. This is the most important part of the ordinance as it is where the chosen methodology is developed.

7. Summary.

Nonstructural alternatives, termed best management practices (BMPs), offer considerable promise as the first line of action when control of urban runoff quality is desired. By treating the problem at its source, or through appropriate legislation curtailing its opportunity to develop, multiple benefits can be derived. These include lower cost, earlier results, and an improved and cleaner neighborhood environment.

The greatest difficulty faced by BMPs is that the action-impact relationship is almost totally unquantified. It is clear that onsite storage, for example, can be closely related to reduced downstream

Table E-5. SUMMARY OF SOME EXISTING LEGISLATIVE STORMWATER MANAGEMENT PROGRAMS

Location	Description of legislation
Denver Urban Renewal Authority	Requires private developers to pond rainfall on rooftops and in plazas of all new and renovated construction. The design criteria for plazas require a runoff rate of 1 in./hr and a water depth of 0.75 in. during the 10 year rain. The values for rooftops are 0.5 in./hr and a depth of 1 in. for the 10 year storm or 3 in. during a 100 year rain.
Naperville, Illinois	Plumbing, sewer, and water ordinance requiring that runoff release rate be regulated by the safe capacity of the receiving water, but no more than 0.15 in./hr. Storage must be designed for the 100 year storm. The ordinance is applicable to all new subdivisions and compliance is required for approval of development permits.
Joliet, Illinois	Ordinance similar to that of Naperville. Requires runoff to meet a variety of criteria: (1) runoff rate shall not exceed historic values, (2) allowable runoff rates are prorated on the basis of stream capacity, and (3) runoff rate shall not exceed that of 2 year storm with a runoff coefficient of 0.3 unless facilities can handle the flow. The ordinance is enforced for 10 acre residential areas and 5 acre nonresidential developments through the issuance of building permits.
Albuquerque Metropolitan Arroyo Flood Control Authority	Requires stormwater detention for all new developments such that downstream drainage facility capacity is not exceeded or the rate of runoff does not exceed the natural rate of flow. Compliance is required for building permits and subdivision plan approval. In addition, a land use not in compliance can be sued as a public nuisance.
Arvada, Colorado	Requires detention for runoff greater than predevelopment rates for new construction. If a developer chooses not to provide the detention he is assessed a one time fee that reflects the cost the city will pay to develop a drainage system. If detention is provided, no fee is assessed.
Boulder, Colorado	Monthly drainage fee that is assessed against all property in the city on the basis of surface area and runoff coefficient. Efforts to retain runoff onsite will result in lower monthly charges.
Metropolitan	Requires provision for stormwater retention before granting sewer connection permits to new developments. The maximum release rate is computed by the Rational Formula with a 3 year rain and a coefficient of 0.15. Storage must be designed for the 100 year storm.
Montgomery County, Maryland	The State of Maryland has classified sediment as a pollutant under its water Pollution Control Act and Montgomery County's program is an example of the result. The recommendations of the SCS on erosion control must be met to obtain clearing and grading permits in the county. Detention ponds are part of the requirements for approval.
Fairfax County, Virginia	The county has a history of runoff control similar to that of Montgomery County. Erosion and sediment control has been mandated during construction since the late 1960s. Temporary detention ponds were used at most sites and permanent detention must be evaluated for all new developers.

conduit requirements but the net water quality benefits are far less defined. Similarly, cleaner streets and neighborhoods and enforced legislation will reduce loadings but to what limit should they be applied and who will bear the cost? The final answers of cost effectiveness will probably not be found short of trial implementation.

The structural alternatives supplementing BMP are briefly discussed in the next section.

B. Corrective Control Measures

Corrective control measures or the treatment of stormwater relies generally on structural methods that are after-the-fact type of mitigation methods. They include the installation of inlets or catchbasins, when desirable, storage facilities to attenuate peak flow and settle out heavy particles, and the use of treatment facilities to remove materials from storm runoff prior to discharge to receiving waters.

1. Inlets and Catchbasins.

An inlet is built at the curbline of a street, for the admission of surface water to a storm drain. A catchbasin includes at its base a sediment sump designed to retain grit and debris below the overflow. In Santa Clara County, drainage inlets are standard practice.

Sediment removal efficiency of catchbasins has been reported to be a function of basin geometry, flowrate, influent solids gradation, and accumulated solids from prior events [E-13]. Accumulated sediment in the basin would not materially affect removal efficiencies until 50% of the sump had filled. The removals of sediments for further storms drop rapidly. Negative efficiencies were experienced before 60% of the sump had filled.

If only half of the available street contaminants in an urban area reach a catchbasin in a typical storm, approximately 0.53 pound of BOD_5 could be retained [E-13]. This would offset the purged load threefold, if the basin is well-designed and maintained.

The range and average unit costs for installation of catchbasins and inlets, as well as conversion of catchbasins to inlets, is presented in Table E-6.

Table E-6. UNIT COST DATA

Item	Installed cost, $[a]	
	Average	Range
Catchbasins	800	400-1,000
Inlets	600	300-800
Conversion of catchbasin to inlet	200	100-500

a. Based on ENRCC index of 2000.

Cleaning methods fall into four main categories: hand cleaning, bucket cleaning, eductor cleaning, and vacuum cleaning. Comparison of APWA survey data [E-14, E-15] shows that, on a national basis, the median cleaning frequency has decreased from twice per year in the 1959 survey to once per year in the 1973 survey. This trend is obviously detrimental from a water quality aspect and illustrates that many problems associated with catchbasins may be traced to inadequate maintenance.

To successfully reduce the "first flush" contaminant load, the cleaning frequency should be adjusted to limit the sediment buildup to 40 to 50% of the sump capacity. Representative maintenance costs are shown in Table E-7.

Table E-7. CATCHBASIN CLEANING COSTS[a] [E-15]

Statistical measure[c]	Manual cleaning			Eductor cleaning			Vacuum cleaning		
	$/catch-basin	$/m^3	($/yd^3)	$/catch-basin	$/m^3	($/yd^3)	$/catch-basin	$/m^3	($/yd^3)
Regions with heavy winter snowfall									
Sample size	17	10		5	6		26	14	
Geometric mean, M_g	10.53	9.08	(6.94)	3.23	3.01	(2.30)	4.94	9.86	(7.54)
Standard deviation, σ_g	4.53	10.10	(7.72)	3.38	17.76	(13.58)	2.97	2.20	(1.68)
National									
Sample size	51	37		10	10		51	37	
Geometric mean, M_g	7.66	18.86	(14.42)	5.92	5.35	(4.09)	7.99	11.24	(8.59)
Standard deviation, σ_g	3.04	11.18	(8.55)	3.30	13.18	(10.08)	3.05	5.95	(4.55)

a. Based on an ENRCC index of 2000.

2. Detention or Retention Storage.

Because of the high volume and variability associated with stormwater, storage is considered a control alternative. Storage facilities are frequently used to attenuate peak flows associated with these discharges, reducing in magnitude and size the facilities required for further treatment. Storage, however, with the resulting sedimentation that occurs due to increased detention times, can also be considered a treatment process. Many such facilities are designed to operate as sedimentation basins as well as storage tanks for flows that exceed the storage capacity.

Storage facilities may be analyzed and designed by various rational methods [E-16]; however, recent studies offer a cost-effectiveness approach for sizing storage facilities coupled with secondary treatment for various contaminant removal constraints [E-17, E-18]. This approach provides a first-cut for comparing alternative costs at different levels of treatment for different combinations of storage treatment processes.

The two types of storage facilities discussed include inline and offline storage.

3. Offline Storage.

Offline storage facilities are essentially detention or retention devices that have both constituent control and peak flow reduction benefits and, where desirable and possible, could augment groundwater infiltration.

Typical offline storage devices include (1) lagoons, (2) primary settling basin-like structures, (3) underground silos, (4) underwater bags, (5) void space storage, and (6) deep tunnels and mine labyrinths [E-16]. In almost all cases, their purpose is feedback of the retained flows to the drainage system for ultimate disposal and they are usually expensive. Underground and offshore storage has also been proposed to meet the land area and cost constraints.

Basic appurtenances common to storage facilities include diversion or regulatory structures, coarse screening, storage overflow structures, and dewatering by pumping or gravity. In addition, storage/detention facilities that provide primary treatment may include all or combinations of (1) fine screening of the influent, (2) chlorination systems, (3) fine screening of the effluent, and (4) sludge/solids collection and removal.

Sludge/solids collection and removal is perhaps one of the most important operations in the storage operation, as inadequate removal can generate volatile gas and cause mechanical malfunctions and odors. Typical collection equipment includes traveling bridge sludge scrapers and hydraulic dredges [E-16, E-19, E-20]; mechanical mixers, recirculation pumps, and compressed air for solids resuspension and removal [E-21, E-22, E-23]; automatic and manual flushing [E-24, E-25]; and use of street sweepers in lined basins [E-26]. Use of automatic and mechanized methods of solids removal was shown to be more effective than manual washdown operations [E-20].

Storage facilities have been designed using concepts based on duration-frequency analysis of local rainfall events [E-16]. Storage selection and sizing also incorporate receiving water conditions as part of the design criteria. Evaluation of the percent reduction of constituents required to obtain the most cost-effective design must also be compatible with water quality goals.

Studies in Milwaukee [E-27] have developed process curves for detention tanks, evaluating pollutant reduction and volumetric efficiency for several tank volumes. Suspended solids and BOD retention and percent of storm volume retained for both wet and dry year rainfalls are shown in Figure E-5. The study also showed a decreasing efficiency per unit volume as tank size increases.

Offline storage facilities have demonstrated their effectiveness in controlling storm and combined sewer overflows. Many regional plans include storage alternatives as an integral part of the overall control process. Characteristics and operational performance of the offline storage facilities are described in the literature [E-16] and are summarized in Table E-8. The costs of these facilities are summarized in Table E-9.

4. <u>Treatment</u>.

Stormwater treatment can include a variety of unit processes including physical treatment, biological treatment, physical-chemical treatment, and disinfection. Detailed evaluation and cost data are summarized in reference [E-16].

C. <u>Implementation Considerations</u>

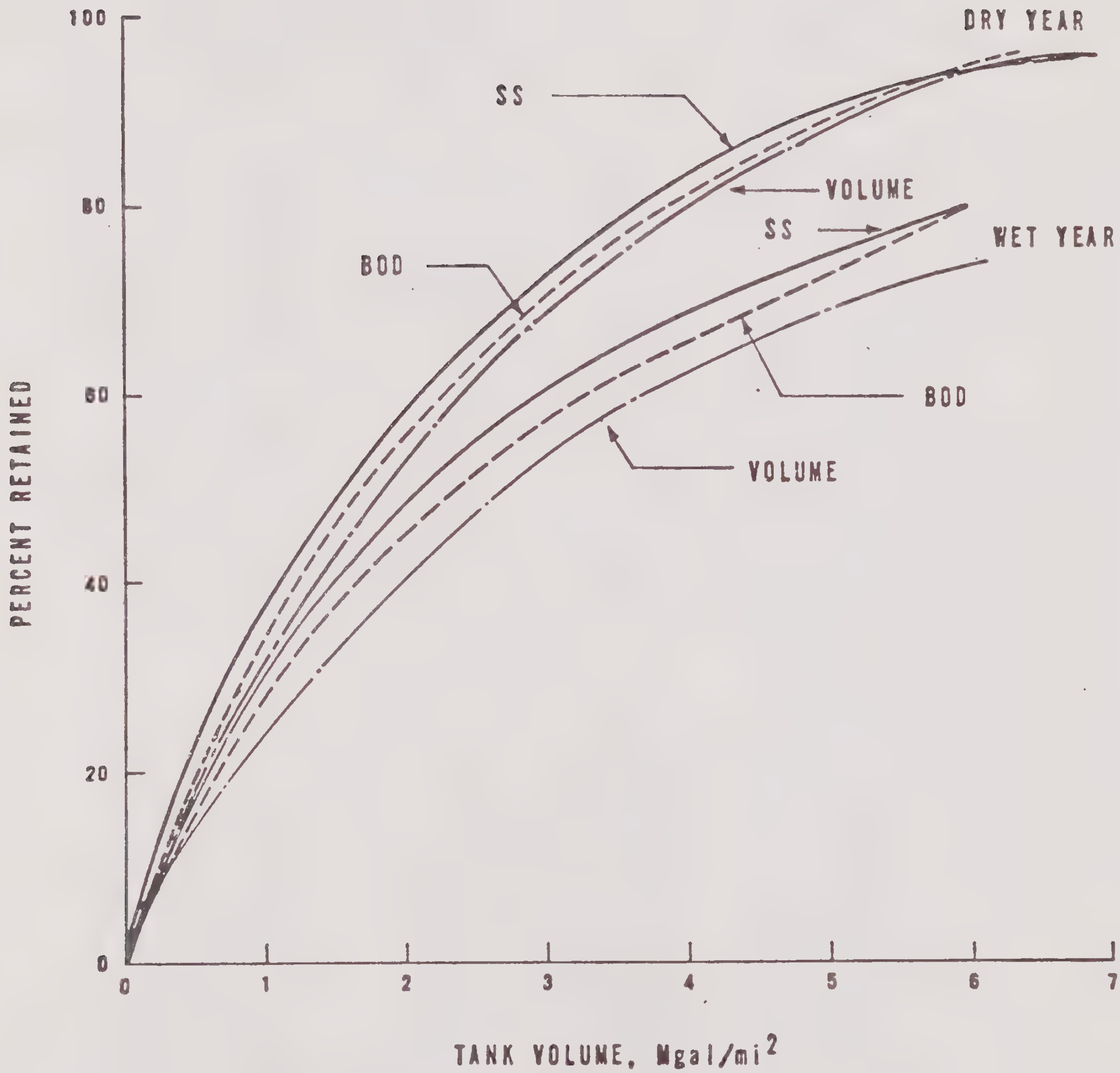
The implementation of a stormwater quality control plan would, in all probability, be carried out by several government entities--agencies with authorities and responsibilities delegated to them. Therefore, implementation would be a joint effort of a governmental system.

1. <u>Identification of Institutions Involved</u>

In confronting ways of implementation, it is important to first identify those institutions of different authorities and functions that hold jurisdiction over the sources of the runoff. This identification depends on knowledge of the following:

1. Drainage characteristics of an area--because drainage rarely conforms to political boundaries, interlocal cooperation must be secured.

2. Characteristics and constituents of runoff--the characteristics of the runoff determine the capability and need of one or more communities to control it. For example, some more exotic toxic (such as PCBs and lead in fuel) may be beyond the authority and power of a local area to control.



Mgal/mi^2 x 1.46 = ML/km^2

FIGURE E-5. POLLUTANT RETENTION VERSUS STORAGE TANK VOLUME FOR WET- AND DRY-YEARS

Table E-8. DESCRIPTION OF OFFLINE STORAGE FACILITIES

Location	Description of facilities	System operation	Comments
Akron, Ohio [E-28]	The underground void space storage tank facilities include a diversion manhole, a 0.38 ML (0.1 Mgal) clarifier, a 3.8 ML(1 Mgal) plastic lined storage basis filled with inert aggregate, an overflow channel to the receiving water, and chlorination facilities. The clarifier chamber contains a tube settler.	Flow is diverted to the clarifier when interceptor capacity is exceeded. As the outlet capacity from the clarifier is exceeded, the flow backs up and overflows to the storage basin. Overflow from the storage basin is discharged to the receiving water. The facilities are dewatered by gravity as interceptor capacity becomes available.	Tube settlers do not work effectively in this application. High solids loading to the exposed media of the storage basin may drastically reduce infiltration rates into the bed.
Milwaukee, Wisconsin [E-27] Humboldt Avenue detention facilities	The facilities include a 14.8 ML (3.9 Mgal) covered concrete storage tank, a mechanically cleaned bar screen, a dewatering pumping station, and chlorination facilities. Solids settled in the tank are resuspended by mechanical mixers prior to dewatering.	The tank serves as a settling basin for combined sewer overflow from large storms and totally contains those of smaller storms. Reduction in volume of 67%, suspended solids of 70%, and BOD of 67% were reported for overflow entering the receiving waters.	Effects of a "first flush" condition are evident in this system.
Boston, Massachusetts [E-25] Cottage Farm detention and chlorination station	The detention and chlorination facilities include a 0.38 ML (0.1 Mgal) wet well, and 6 parallel covered concrete storage basins totaling 4.54 ML (1.2 Mgal). The facilities also include prescreening, chlorination, and fine screening of the effluent.	The influent channel is designed to permit sequential filling of the basins as capacity is needed. Reduction in volume of 14%, suspended solids of 45%, and BOD of 42% were reported for overflow entering the Charles River. Small storms that are totally contained and the contents of the basins after large storms are returned to the interceptor for treatment.	The main purpose of this facility is treatment by sedimentation during large overflow events as indicated by the percent volume reduction.
New York City, New York [E-29, E-30, E-31, E-32] Spring Creek	Spring Creek has 6 covered concrete retention basins with a total capacity of 46.9 ML (12.4 Mgal). An additional 72.7 ML (19.2 Mgal) of storage was estimated to exist in the interceptor system. The facilities include mechanically cleaned bar racks, chlorination, centrifugal grit separators, and traveling bridge hydraulic sludge collectors.	The retention basins provide removal of settleable solids and floatables from overflows, together with disinfection. The system was designed to contain 50% of the summer storms; however, due to the large storage capacity in the intercepting sewer, 80 to 85% of the summer storms are contained. Removals from the overflow from storage to the receiving water are: suspended solids, 40%; BOD, 30%; setteable solids, 92%.	Potential overflow is estimated to occur with 0.81 cm (0.32 in.) of rainfall. No estimate of percent volume, suspended solids, and BOD (mass basis) reduction to the receiving water is available.

Table E-8 (Continued)

Location	Description of facilities	System operation	Comments
Chippewa Falls, Wisconsin [E-26]	The open storage facilities include a diversion structure, bar screen, pumping station, 10.7 ML (2.8 Mgal) open asphalt-lined storage basin, and a pond overflow structure. Solids removal is facilitated by mechanical street sweepers.	The primary function of the facilities is to store potential overflow, returning them to the interceptor as treatment capacity becomes available. Volume reduction was 93.7%; 95.8% of the suspended solids and 98.2% of the BOD were prevented from entering the Chippewa River.	The dry-weather treatment plants secondary clarifiers were increased in size to retain solids as a result of the increased flow from storage. No detrimental effects on the activated sludge process have been noted as a result of the storage facility.
Chicago, Illinois [E-16, E-19, E-33]	The deep tunnel project includes tunnels for transmission and storage, mined quarries for treatment by sedimentation, and improvements to dry-weather treatment plants to handle the increased wet-weather flow. The tunnel system includes 201 km (125 miles) of deep rock tunnels with an estimated storage capacity of 11 350 ML (2 998 Mgal), and verticle drop shaft entrance structures. Quarry storage is estimated at 156 400 ML (41 315 Mgal). The quarry system includes mechanical aeration, hydraulic dredge sludge removal, and pumping.	The first phase tunnels, storage only without reservoirs, are estimated to reduce overflows from 100 to 10 per year. With only the tunnels in operation, the BOD reduction is expected to be 90% and the volume reduction to the river, 75%. Final plans include instream aeration in addition to the tunnels, reservoirs, and treatment plant improvements to meet dissolved oxygen requirements over the entire 129 km (80 miles) of waterways during critical summer conditions.	Presently three segments of the tunnel system are on line. These include (1) Brookfield La Grange, (2) Crawford Avenue, and (3) Lawrence Avenue. The frequency of overflow using this plan is estimated to be 4 times in 21 years.
Sandusky, Ohio [E-16, E-24]	The offshore underwater storage facility includes a leaping weir regulator, bar screen, diversion weir to allow filling of either or both of the tanks, 2 nylon-reinforced synthetic rubber storage tanks, and dewatering pumps. The storage capacity is 1.36 ML (0.36 Mgal), including the added capacity due to fabric elongation.	Overflow from the combined sewer system is diverted to the underwater storage tanks, and after capacity is reached is directed out the safety overflow. The tanks are dewatered back to the interceptor as treatment capacity becomes available. The system retained 50% of the overflow volume and over 90% of the pollution load. Overflow from the facility occurred approximately 1% of the time.	Operational problems encountered with some of the support equipment included: backflow valves, pressure relief valves, and the tank level control system. Accumulation of silt also created operational problems.

Table E-8 (Concluded)

Location	Description of facilities	System operation	Comments
Washington, D.C. [E-16, E-23]	Combined sewer overflow is stored in 2 underwater nylon reinforced synthetic rubber storage tanks. The storage volume is 0.76 ML (0.2 Mgal). The facilities also include grit chambers, bar screen, comminutor, and return pumping plus instrumentation.	The facilities were designed to contain a portion of the first flush from the combined sewer system. Stored stormwater and solids are pumped to an interceptor after storm flows subside. Approximately 6.06 ML (1.6 Mgal) of overflow has been diverted to storage from 38 storm events.	Operational problems included bag anchoring and tearing, air release devices, and general equipment malfunctions. Compressed air was injected into the storage bags to agitate settled solids for pumping to the interceptor.
Columbus, Ohio [E-17, E-20] Whittier Street	Three open concrete storm standby tanks with a total volume of 14.2 ML (3.75 Mgal) were constructed in 1932 with modifications made in 1967. The facilities include traveling bridge sludge scrapers, sludge removal pumps, and regulator structures and gates.	The main process of pollutant removal is sedimentation. A rainfall of about 0.51 cm (0.2 inc.) over the drainage area will put the tank in operation. After storm flows subside, solids are pumped back to the interceptor for further treatment,	Pollutant removal rates due to sedimentation are discussed in the next section.
Cambridge, Maryland [E-22]	This underwater storage facility consists of flow metering, bar screen, diversion manholes, a pumping station, and a 0.94 ML (0.248 Mgal) underwater steel storage tank with a flexible rubber diaphram.	The capacity of the facility is sufficient to totally contain 40 of the 55 storms per year and about 96% of the total annual overflow volume. The facility will capture an estimated 3 240 kg (7 136 lb) of the 3 370 kg (7 435 lb) of BOD in the combined sewer overflow, or about a 96% reduction.	Due to unfavorable public acceptance, the pilot plant facility was removed from the site before completing a satisfactory evaluation. Site selection was proved to be a critical design factor to prevent public disturbance, and includes land use, tidal conditions, and the type of storms to be captured.

Table E-9. SUMMARY OF OFFLINE STORAGE COSTS

Location	Storage capacity Mgal	Drainage area, acres	Capital cost, $	Storage cost, $/gal	Cost per acre, $/acre	Annual operation and maintenance cost, $/yr
Akron, Ohio	1.1	188.5	455 700	0.41	2 420	2 900
Milwaukee, Wisconsin						
Humboldt Avenue	3.9	570	1 774 000	0.45	3 110	51 100
Boston, Massachusetts						
Cottage Farm Detention and Chlorination Station	1.3	15 600	6 495 000	5.00	416	80 000
Charles River Marginal Conduit Project	1.2	3 000	9 488 000	7.91	3 160	97 600
New York City, New York						
Spring Creek Auxiliary Water Pollution Control Plant						
Storage	12.39	3 260	11 936 000	0.96	3 660	100 200
Sewer	19.15	.....	....	....	.....	....
	31.54	3 260	11 936 000	0.96	3 660	100 200
Chippewa Falls, Wisconsin						
Storage	2.82	90	744 000	0.26	8 270	2 700
Treatment	....	..	189 000	....	2 100	8 000
	2.82	90	933 000	0.26	10 370	10 700
Chicago, Illinois						
Tunnels and pumping	2 998	240 000	870 000 000	0.29	3 630	......
Reservoirs	41 315	....	682 000 000	0.02	2 840	......
Total storage	44 313	240 000	1 552 000 000	0.04	6 470	......
Treatment	......	....	1 001 000 000	....	4 170	......
	44 313	240 000	2 553 000 000	0.04	10 640	8 700 000
Sandusky, Ohio	0.36	14.86	520 000	1.44	35 000	6 200
Washington, D.C.	0.20	30.0	883 000	4.41	29 430	3 340
Columbus, Ohio						
Whittier Street	3.75	29 250[c]	6 144 000	1.64	210	....
Cambridge, Maryland	0.25	20	320 000	1.28	16 000	14 400

3. Land use patterns--the nature of the land use in an area will provide indications of the cooperation necessary to perform BMPs. For example, clustered communities may benefit and realize cost savings from interlocal agreements to conduct maintenance techniques such as street sweeping and inlet cleaning.

2. Institutional Cooperation

A second consideration would be the identification of the institutional cooperation required to carry out the recommended plan. This means gaining the compliance of public water departments, soil conservation districts, and enforcement agencies toward agreed upon objectives. For example, sediment control practices usually require some sort of permitting scheme on development. For this permitting system to operate, enforcement becomes important. Performance bonding may be a vehicle. However, if the performance granter lapses, the enforcement agency would have the responsibility to ensure correction by the developer. The recommended plan must consider the implications for its continuation in order to avoid recommendation of practices and structures that may create problems later.

3. Public Education and Participation

In the planning process, the nature of the runoff problem may be conceived of in concise terms, coordination plans can be developed for control techniques, and maintenance requirements passed into law--but still the plan may not be implemented without a concerted effort to educate not only those who will bear the brunt of the regulation, but the public as well.

For example, when Dekalb County, Georgia, passed its runoff control ordinance, the contractors and developers reportedly accepted the restrictions as outlined in the ordinance and fewer problems resulted. One reason for this lack of problems could be that the drainage department conducted a series of workshops in which the drainage ordinance was explained and where the contractors and developers had the opportunity to ask questions concerning the application of the ordinance.

Another approach is to create blue-ribbon subcommittees, such as those of the Metropolitan Sanitary District in Chicago. This committee was composed of representatives from the sanitary district, consulting firms, contractors, developers, public works personnel, and interested citizens. A wide range of disciplines and backgrounds can then contribute to the development of policy and can add measurably to the success of a program.

The development of public service announcements for broadcast by local television is another way of attacking the problem of public participation. The Huron River Watershed Council in Michigan achieved great success with this method. The Stormwater Runoff Program within the Water Planning Division of the EPA has developed a slide presentation for use of areawide 208 agencies on the problem of stormwater runoff and what can be done to abate it.

5. Conclusion

The basic concept of BMP is to choose the most cost effective combination of measures in a systematic manner. These implementation considerations would be worthy of review in the planning process.

Appendix E

REFERENCES

1. Everhart, R.C. New Town Planned Around Environmental Aspects. Civil Engineering - ASCE. September 1973.

2. McCuen, R.H. Flood Runoff from Urban Areas. Office of Water Research and Technology. Technical Report No. 33. June 1975.

3. McPherson, M.B. Utility of Urban Runoff Modeling. (Proceedings of a Special Session, Spring Annual Meeting, American Geophysical Union, Washington, D.C., 14 April 1976) ASCE Urban Water Resources Research Program, Technical Memorandum No. 31. July 1976. Draft.

4. Sartor, J.D. and G.B. Boyd. Water Pollution Aspects of Street Surface Contaminants. U.S. Environmental Protection Agency. Office of R&D, Washington, D.C. EPA-R2-72-081. November 1972. 236 pages.

5. American Public Works Association. Water Pollution Aspects of Urban Runoff. Federal Water Pollution Control Administration, U.S. Department of the Interior. January 1969.

6. Casey, J.R. Our Crash Street-Cleaning Program ... Covers Every Street in the City in Five Days. The American City. July 1970.

7. Huber, W.C., J.P. Heaney, M.A. Medina, W.A. Peltz, H. Sheikh,, and G.F. Smith. Storm Water Management Model User's Manual, Version II. U.S. Environmental Protection Agency. Office of R&D. National Environmental Research Center, Cincinnati, Ohio. EPA-670/2-75-017. March 1975. 351 pages.

8. State of Maryland, Department of Water Resources and B.C. Becker and T.R. Mills, Hittman Associates, Inc., Columbia, Maryland. Guidelines for Erosion and Sediment Control Planning and Implementation. U.S. Environmental Protection Agency. Office of Research and Monitoring, Washington, D.C. EPA-R2-72-015. August 1972. 228 pages.

9. Bhutani, J., R. Holberger, P. Spewek, W.E. Jacobsen, and J.B. Truett. Impact of Hydrologic Modifications on Water Quality. U.S. Environmental Protection Agency. Office of Research and Development, Washington, D.C. EPA-600/2-75-007. April 1975. 540 pages.

10. Burton, J. and E. Kreusch. Industrial Water Softener Waste Brine Reclamation. U.S. Environmental Protection Agency. Office of Research and Development, Washington, D.C. EPA-660/2-74-007. February 1974. 158 pages.

11. Brater, E.F. and J.D. Sherrill. Rainfall-Runoff Relations on Urban and Rural Areas. U.S. Environmental Protection Agency. Office of R&D. National Environmental Research Center, Cincinnati, Ohio. EPA-670/2-75-046. May 1975. 98 pages.

12. Debo, T.N. Survey and Analysis of Urban Drainage Ordinances and a Recommended Model Ordinance. Environmental Resources Center and Georgia Institute of Technology. ERC-0475. February 1975. 294 pages.

13. Lager, J.A., W.G. Smith, and G. Tchobanogbus, Metcalf & Eddy, Inc. in association with Hydro-Research Science. Catchbasin Technology Overview and Assessment. U.S. Environmental Protection Agency. Contract No. 68-03-0274. December 1976. Draft Final Report.

14. San Francisco Master Plan for Waste Water Management, Preliminary Comprehensive Report. City and County of San Francisco, Department of Public Works. September 1971.

15. American Public Works Association. Survey of Practice as to: Street Cleaning Catch Basin Cleaning, Snow and Ice Control. March 1973.

16. Metcalf & Eddy, Inc. Urban Stormwater Management and Technology, An Assessment. U.S. Environmental Protection Agency. Office of R&D. National Environmental Research Center, Cincinnati, Ohio. EPA-670/2-74-040. December 1974. 471 pages.

17. Heaney, J.P., W.C. Huber, and M.P. Murphy. Nationwide Assessment of the Cost of Controlling Pollution from Combined Sewer Overflows, and Stormwater Runoff from Sewered and Non-Sewered Urban Areas (First Draft). Department of Environmental Engineering Sciences, University of Florida, Gainsville. June 1975. 119 pages.

18. Heaney, J.P., W.C. Huber, and S.J. Nix. Storm Water Management Model Level I, Preliminary Screening Procedures. U.S. Environmental Protection Agency. Project No. R-802411. Draft.

19. U.S. Environmental Protection Agency and Booz, Allen and Hamilton Inc. Draft Environmental Impact Statement. Tunnel Component of the Tunnel and Reservoir Plan Proposed by the Metropolitan Sanitary District of Greater Chicago; Mainstream Tunnel System, 59th Street to Addison Street. March 1976.

20. Dodson, Kinney and Lindblom. Evaluation of Storm Standby Tanks. Columbus, Ohio. U.S. Environmental Protection Agency. 11020 FAL. March 1971.

21. City of Milwaukee, Wisconsin, and Consoer, Townsend and Associates. Detention Tank for Combined Sewer Overflow, Milwaukee, Wisconsin, Demonstration Project. U.S. Environmental Protection Agency. Municipal Environmental Research Laboratory, Cincinnati. EPA-600/2-75-071. December 1975. 308 pages.

22. Melpar - An American-Standard Company. Combined Sewer Temporary Underwater Storage Facility. Federal Water Quality Administration. 11022 DPP. October 1970.

23. Underwater Storage, Inc., and Silver, Schwartz, Ltd. Control of Pollution by Underwater Storage. Federal Water Pollution Control Administration. 11022 DWF. December 1969.

24. Karl R. Rohrer Associates, Inc. Underwater Storage of Combined Sewer Overflows. U.S. Environmental Protection Agency. 11022 ECV. September 1971.

25. Commonwealth of Massachusetts Metropolitan District Commission. Cottage Farm Combined Sewer Detention and Chlorination Station, Cambridge, Massachusetts. U.S. Environmental Protection Agency. Office of Research and Development, Washington, D.C. EPA Grant No. 11020 FAT. Draft.

26. Liebenow, W.R., and J.K. Bieging. Storage and Treatment of Combined Sewer Overflows. U.S. Environmental Protection Agency. EPA-R2-72-070. October 1972.

27. City of Milwaukee, Wisconsin, and Consoer, Townsend and Associates. Detention Tank for Combined Sewer Overflow, Milwaukee, Wisconsin, Demonstration Project. U.S. Environmental Protection Agency. Municipal Environmental Research Laboratory, Cincinnati. EPA-600/2-75-071. December 1975. 308 pages.

28. Karl R. Rohrer Associates, Inc. Demonstration of Void Space Storage with Treatment and Flow Regulation. U.S. Environmental Protection Agency. Contract No. 11020 DXH. Draft: Final Report.

29. H.F. Ludwig & Associates and Engineering-Science, Inc. Spring Creek Auxiliary Water Pollution Control Project. Volume I & II. U.S. Environmental Protection Agency. Contract 11023 FAO. April 1974.

30. Lynard. W.G. Trip Report, Denver, Chicago, Kenosha, Racine, Milwaukee, Toronto, and New York City. June 21-25, 1976.

31. City of New York Environmental Protection Administration. Spring Creek Auxiliary Water Pollution Control Plant Operational Data, January 1974 to January 1976.

32. Feuerstein, D.L., and W.O. Maddaus. Wastewater Management Program, Jamaica Bay, New York. Volume I: Summary Report. U.S. Environmental Protection Agency. EPA-600/2-76-222A. September 1976.

33. Development of a Flood and Pollution Control Plan for the Chicagoland Area. Metropolitan Sanitary District of Greater Chicago, Institute for Environmental Quality, State of Illinois, and Department of Public Works, City of Chicago. August 1972.

APPENDIX F

FORMULATION OF SURFACE RUNOFF MANAGEMENT PLAN

Appendix F

FORMULATION OF SURFACE RUNOFF MANAGEMENT PLAN

PLAN FORMULATION CONSIDERATIONS

Several important factors involving data deficiency were recognized and were considered in the plan formulation:

- Lack of baseline quality data -

  As the surface runoff quality problem is complex in nature, the lack of long-term monitoring data, coupled with the drought condition experienced during the sampling period, seriously handicapped the effort to establish baseline quality data. The baseline quality data would ideally include the runoff from upper watersheds representing the virgin condition of undeveloped lands. This information is necessary in forming the basis of comparison of changes in contaminant loadings due to various human activities.

  The lack of surface runoff in the agricultural area in South County has also prevented the forming of a data base on two of the sampling stations established.

- Lack of knowledge of receiving water assimilation capacity -

  To properly assess the degree of seriousness of constituents identified as contaminants, the assimilation capacity of the receiving water should be established. The assimilation capacity of South San Francisco Bay has not been clearly identified, especially that associated with potential contaminants generated from surface runoff, namely, sediments, with the possible inclusion of heavy metals. As a result, the qualtity of pollutants generated from surface runoff to be tolerated by the Bay during a storm event or a rainy season is yet to be defined. This lack of knowledge makes it difficult to determine the level of effort necessary to manage the surface runoff, in an attempt to ultimately protect the integrity of water quality in South San Francisco Bay.

- Lack of water quality objectives for inland streams -

  Most of the inland streams in Santa Clara County are dry creeks for most of the year. The water quality objectives are not clearly defined for the beneficial uses as designated in the Basin Plan. In addition, the beneficial uses designated for some creeks (such as the recreation use for Guadalupe River) with flow all year-round may not apply to wet-weather conditions. Therefore, the level of control for runoff quality if necessary, cannot be properly determined.

- Lack of data base for assessing the effectiveness of control measures -

  In addition to the lack of data base for establishing water quality objectives, the effectiveness of control measures for surface runoff, especially those defined as Best Management Practices, are not clearly defined. For example, the percent of removal of pollutants due to the implementation of a litter control ordinance cannot be calculated. In some cases, the percent of removal can be roughly estimated, but the benefit derived from these control measures cannot be determined due to the lack of water quality objectives. Examples for this case include street sweeping and erosion control.

- Lack of knowledge of current surface runoff quality associated activities -

  As surface runoff quality is a relatively new concern compared to point source discharges, there is generally a lack of awareness of its source and control methods. As discussed in previous appendixes, most of the sources of contaminants for surface runoff are caused by human activity, such as the automobile, illegal dumping of oil in storm drains, disposing of animal carcasses in stream channels, littering, and soil loss due to agricultural and construction activities.

  On the other hand, a large number of activities are being carried out; though not originated for surface runoff management, they have considerable impact on surface runoff quality.

  Present activities include street sweeping, stream channel cleaning and maintenance, soil conservation, and flood control measures and are incorporated in the plan. But the effectiveness of these programs is yet to be assessed in order to form the basis for directing future activities.

As the result of these data deficiencies, surface runoff management can be recognized as an additional element of environmental concern. The implementation of a plan should therefore take into cognizance other vital needs that exist in Santa Clara County that also have a high priority for funding.

The strategy of plan formulation could conceivably be to supplement the necessary data needs for the initial planning effort before recommending additional best management practices. The continuing planning process could seek to identify of water quality objectives, monitor the effectiveness of the program, and recommend modification of the surface runoff management plan, as found necessary.

SURFACE RUNOFF MANAGEMENT ACTIVITIES

The surface runoff management activities for Santa Clara could include several key elements aiming at a complete assessment of current activities and development of effective management practices through the continuing planning processes.

- Basic sampling program
- Demonstration projects
- Current surface runoff management practices
- Future planning
- Public information and education
- Legislative control
- Continuing monitoring program

A summary of these surface runoff management activities is presented in Table F-1. Detailed discussion of these activities are presented in the following section.

I. Basic Sampling Program

Purpose. The purpose of a basic sampling program would be to generate water quality information from various land use areas and supplement the baseline water quality data on surface runoff in Santa Clara County. The assimilation capacity of the South San Francisco Bay needs to be determined, but could probably best be done by a regional entity.

Action.

1. Coordinate current sampling efforts of the Santa Clara Valley Water District, USGS, Corps of Engineers, RWQCB, and ABAG.
2. Identify local program needs and establish tentative programs.
3. Estimate budgetary requirements and seek funds.
4. Retain contractor* and refine sampling program.
5. Conduct sampling and testing

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*Contractors retained could be agencies such as RCDs, special districts, ABAG, or private consultants.

TABLE F-1

SURFACE RUNOFF MANAGEMENT ACTIVITIES SUMMARY

	Plan elements	Actions	Implementing agency	Estimated cost, $	Remarks
I.	Conduct basic sampling program	• Coordination and administration	CA[1]	2,000	Sampling to be conducted on discrete land uses to supplement baseline data on surface runoff and receiving waters in Santa Clara County.
		• Sampling and testing	Contractor[2]	50,000	
		• Data analysis, evaluation, and report preparation	CA	8,000	
II.a.	Engage in San Jose street sweeping program	• Coordination	CA	2,500	
		• Street sweeping program evaluation criteria development	Contractor	10,000	
		• Program evaluation	Cities and county	NI[3]	
b.	Engage in Palo Alto Flood Basin demonstration project	• Proposal preparation	CA	2,000	
		• Work program development	CA	25,000	
		• Study and report preparation	Contractor	123,000	
III.	Review current surface runoff management practices	• Coordination and administration	CA	1,000	
		• Current activities	Cities, county, special districts, RWQCB, ABAG, EPA	NI	
		• Data compilation and report preparation	CA	6,000	
		• Report review and program assessment	Cities, county, and special districts	NI	
IV.a.	Develop surface runoff management guidelines for EIR evaluation of public and private facilities	• Coordination and administration	CA	5,000	
		• Guideline development	Contractor	25,000	
		• Guideline review and adoption	Cities, county, and special districts	NI	
b.	Evaluate surface runoff management of public and private facilities as part of EIR review process	• Review EIRs of public and private facilities in accordance with guidelines provided	EIR review agencies	--	Program to be conducted on a yearly basis
		• Report on guideline deficiencies and recommended improvements	EIR review agencies	15,000	
		• Compile inputs and recommend on guideline improvements.	CA	15,000	
		• Incorporate recommendations in Annual report	CA	--	

TABLE F-1 (Concluded)

	Plan elements	Actions	Implementing agency	Estimated cost, $	Remarks
V.a.	Develop public information and education program	• Coordination and administration	ABAG	5,000	
		• Develop public information and education program	Contractor	50,000	
b.	Participate in public information and education program	• Formulate program, estimate funding requirements for Santa Clara County	CA	5,000	
		• Participate in public information and education program	As designated in the program	NI	
VI.a.	Develop model ordinance criteria	• Coordination and administration	CA	6,000	
		• Model ordinance survey and evaluation criteria development	Contractor	25,000	
		• Review of existing ordinances	Cities, county, and special districts	NI	
b.	Modify existing ordinances and adopt necessary new ordinances	• Modify existing ordinance and/or adopt new ordinances	Cities, county, and special districts	NI	Program to be conducted on a yearly basis
		• Report activities	Cities, county, and special districts	NI	
		• Prepare summary report as part of continuing monitoring process	CA	NI	
VII.	Establish continuing monitoring program	• Coordination and administration	CA	5,000	
		• Program development Progress monitoring documentation Annual report preparation and plan improvements recommendation	Contractor	30,000	
		• Report review and approval	Cities, county, and special districts	NI	

[1]CA = Coordinating Agency

[2]Contractors retained could be agencies such as RCDs, special districts, ABAG or private consultants

[3]NI = not included

6. Analyze data and modify baseline conditions as required.

7. Summarize findings and report baseline water quality assessment

Description. The basic sampling program might consist of six sampling stations covering the residential, commercial, industrial, agricultural, undeveloped, and mixed land use patterns. Sampling frequency could vary between 2 to 4 times a year with analyses performed on suspended solids; volatile suspended solids; BOD; nitrogen; phosphorus; heavy metals, such as lead, mercury, cadmium, chromium, and zinc; coliforms, fecal coliforms; oil and grease; and pesticides.

Cost. The annual cost of such a basic sampling program would be approximately $50,000 for conducting the sampling and analytical work. The total cost, including administration and evaluation of data would probably be around $60,000 per year.

Financing Mechanisms. The potential sources of funding for the basic sampling program are EPA monitoring programs funds, local funds, or contributions from local governments and special districts.

2. Demonstration Projects

As discussed previously, the data deficiency on management practices makes it difficult to analyze the cost effectiveness of specific control measures. To engage in demonstration projects on these control measures could be a positive effort to establish the data base necessary for assessment.

In Santa Clara County, there is one EPA funded demonstration project currently under study in the City of San Jose. The scope of the study calls for the evaluation of various street sweeping practices. The study is expected to be completed and approved by the EPA in May 1978.

The Palo Alto Flood Basin, an area covering 600 acres of bayland, serves as a flood retention basin for the Adobe, Barron, and Matadero creeks to prevent flooding of the lowlands during times of high tide. The impact of this facility on surface water quality has not yet been defined. The quantification of its water quality impact could provide additional data for cost-benefit analysis of the construction of flood basins with surface water quality control as one purpose.

EPA - San Jose Street Sweeping Project -

Purpose. To obtain data from the project and, if necessary, further develop it into criteria for assessing and evaluating the street sweeping programs in Santa Clara County. Data obtained could be used to formulate guidelines for the development of the most cost-effective street sweeping program by individual cities.

Actions.

1. Debrief by City of San Jose or Woodward-Clyde Engineers on the status of the study

2. Obtain report upon its completion

3. If information in No. 2 is sufficient: develop criteria for street sweeping programs evaluation

4. Establish guidelines for developing cost-effective programs

5. Make information generated in No. 4 available to each city and county for review of existing programs

6. Report by cities and county on findings and modifications of programs.

7. If the information in No. 2 is not sufficient or adequate, coordinate with possibly the City of San Jose in seeking additional demonstration project funds from EPA and conduct study designed to satisfy specific needs.

Cost. The cost for the coordination effort could amount to $2,500. The cost for developing evaluation criteria and model program guidelines could vary in the range of $5,000 to $10,000, depending on the data output of the study. The cost for program review and modification by individual cities could vary from $200 to $10,000 depending on the size of individual program. The cost for an additional demonstration study depends on the outcome of the current study and cannot be properly estimated presently.

Financing Mechanism. The cost of program review and modifications could be funded by individual cities and the county. The administrative costs could be funded by contributions from each city and the county in the amount approximately proportional to the size of each program.

Palo Alto Flood Basin -

Purpose. The purpose of engaging in a demonstration project on the Palo Alto Flood Basin would be to identify the function of a flood control storage facility such as the Palo Alto Flood Basin on the surface runoff quality, to develop benefit assessment criteria for cost-effectiveness analysis of similar facilities, and to develop optimum design criteria for design of such facilities incorporating flood control, wetland preserve, wildlife refuge, and runoff quality management.

Actions.

1. Prepare proposal for ABAG and submit to EPA for demonstration project funding.

2. Upon project approval by EPA, develop work program.

3. Conduct study.

4. Upon completion of project, submit report to EPA, ABAG, and interested agencies in Santa Clara County.

5. Incorporate the information obtained into the continuing planning process.

Description. A demonstration project on the water quality study of the Palo Alto Flood Basin would necessarily involve an extensive data collection effort on the quantity and quality of inflows as well as outflows. Mathematical models could be used to simulate and predict water quality changes under various storm conditions. Water quality parameters which are of interest include suspended solids, dissolved oxygen, BOD, salinity, and heavy metals, such as lead. The other half of the major effort would involve the analysis of boundary conditions versus effectiveness in flood control, water quality management, and preservation of marshland and wildlife, and the cost associated with these boundary conditions.

Cost. As the development of a detailed scope of work for the Palo Alto Flood Basin demonstration project is beyond the scope of this study, the preliminary assessment of this program indicates the cost would be in the range of $150,000 to $200,000. The cost of preparing the proposal is estimated to be approximately $2,000 to $2,500. As the project would span a 2-year period, the average cost on a yearly basis would be $75,000 to $100,000.

Financial Mechanism. The potential sources of funds to finance this project could be EPA demonstration project funds.

3. Review of Current Surface Runoff Management Practices

Purpose. To build up the background knowledge of the current level of effort in these surface runoff associated management practices in order to more efficiently direct future surface runoff management activities.

Actions.

1. Obtain from each implementing agency their respective activities associated with surface runoff control.

2. Prepare summary reports by cities, county, and special districts.

3. Compile information from all sources and produce summary report for all activities on a yearly basis.

4. Evaluate summary report with each agency and identify specific program deficiencies and work out program improvements.

5. Monitor progress of improvements on an annual basis.

Description. The current surface runoff associated management practices which were readily identified include the street sweeping and street maintenance programs implemented by each city and county, the stream channel maintenance and sediment control programs implemented by the Santa Clara Valley Water District, and soil conservation, range land, dairy farm, and other open land management by Resources Conservation Districts.

The type of information needed to be collected could be a summary of the method, type of equipment, area of services, manpower requirements, and fiscal requirements. When these data are compiled on a countywide basis, the level of effort which has directly or indirectly contributed to the improvement of surface runoff quality could be readily identified.

With this knowledge and understanding of current activities, the future effort might be better directed and individual programs could be improved. Areas of improvements could be the establishment of cooperative programs among cities in street sweeping and maintenance practices, or the consolidation of these efforts. The priorities of individual programs within one implementing agency could possibly be shifted when the surface runoff management concept is incorporated in the evaluation process.

Cost. The cost of administration and coordination of this type of program is possibly in the neighborhood of $7,000 excluding the compiled data by each implementing agency. The cost to review the activities could range from $500 to $2,000.

Financing Mechanism. The cost of reviewing each agency's current management practices could be funded by each agency. The cost of administration and coordination of this effort could be contributed by each city, county, and special districts.

4. Future Planning

Purpose. To ensure the surface runoff management concept is incorporated in the future planning process for all public and private facilities.

Action.

1. Develop list of categories of public and private facilities which require environmental impact analysis

2. Estimate budget requirements and seek funds

3. Retain contractors to develop guidelines and evaluation criteria for alternative evaluation with respect to surface runoff management for various categories of facilities.

4. Provide each city, county, and special districts and other EIR reviewing agencies with guidelines and evaluation criteria

5. Gain input from EIR review agencies on a yearly basis.

6. Modify guidelines and make improvements.

Description. The categories for public and private facilities can be divided, in general, into water resources, municipal, transportation, commercial and industrial, agricultural, residential, and others.

On the completion of guideline development, the information developed should be reviewed by WRCB, ABAG, RWQCB, and others, and possibly adopted by each governing body as policies for implementation. The surface runoff management aspect of alternatives developed for each proposed facility should be evaluated on the same basis as air quality, noise, and other environmental elements before the selection of the most feasible alternative.

As discussed previously, there are data deficiencies in evaluation of various surface runoff management practices; therefore, the initial guidelines should be aimed at achieving qualitative assessment. With the implementation of other programs and the increase in data base, quantitative assessment criteria could be supplemented to the initial guidelines as part of the continuing planning process.

Cost. The costs might range from $25,000 for a broad scope outline guideline to over $50,000 for a comprehensive step-by-step description of the evaluation process. Coordination effort and program improvement involved in this task might amount to approximately $5,000 per year.

Financing Mechanism. The cost for the program could be funded by local contributions to perform administration, coordination, and development of guidelines. The cost of evaluation of the surface runoff element of individual projects would be part of the EIR review cost. A possible source of funding for developing the evaluation guidelines would be the EPA demonstration project fund.

5. Public Information and Education

Purpose. To improve public awareness of surface runoff-associated problems and the impact on receiving waters as the result of normal human activity compounded by negligence.

Action.

1. Begin preliminary planning and estimate funding requirement.

2. Seek funds from potential sources.

3. Retain public information and education consultants.

4. Develop public information program and public awareness monitoring program. Incorporate surface runoff concept in school curriculum as part of the environmental education program.

5. Participate in implementation of program through public forums, workshops, news releases, etc., and regular school curriculum.

6. Monitor public awareness at intervals recommended by the consultants.

Description. A public information program would most likely consist of news releases through various types of news media, conducting of public workshops, forums, with perhaps the distribution of posters, buttons, and bumper stickers. The education program would be most effective if it is conducted in the elementary schools where the life style and personal habits of children could still be rectified. As these programs are very costly to develop, and a successful program could be used regionwide, statewide, or on a nationwide basis, it would be reasonable to suggest that ABAG, as part of EPA's demonstration program, engages in the active role seeking funds, retaining consultants, and developing programs.

Cost. The cost of a public information and education program could vary widely depending on the scope it covers. The development of these programs would most likely depend on the budgetary constraints. The cost of administration, coordination, and implementation of such a program would also vary with the activities as recommended in these programs.

6. Review/Adopt Legislative Control

Purpose. To ensure that the objective, regulations, implementation, and enforcement of each ordinance is well defined while incorporating the surface runoff management concept.

Action.

1. Coordinate with ABAG and other counties in their effort to develop model ordinances.

2. Estimate funding requirement for this task and seek funds.

3. Select contractor to perform this work if desired.

4. Conduct a survey on model ordinances.

5. Develop guidelines and key elements for evaluating existing ordinances and/or establish new ordinances.

6. Provide each city, county, and special districts with these model ordinance guidelines for review and comment.

7. Incorporate comments and finalize guidelines.

8. Review, modify, or adopt new ordinances by each city, county, and special districts using approved guidelines and criteria.

Description. Since many of the Bay area cities, counties, and special districts have ordinances similar in nature (such as contruction site erosion control, litter control, stream channel dumping, etc.), the survey of model ordinances, development of evaluation guidelines, and implementation criteria could be a coordinated effort by other counties or assumed by ABAG. With the interested county contributing a share of the work, i.e., developing guidelines for two to three ordinances or contributing a share of the fund for ABAG to develop these guidelines, the cost might be subsequently less than development of these guidelines by one county for its own use.

A suggested, but not inclusive, list of ordinances that might be considered by interested governments is presented in Table F-2.

Cost. The cost of administration and the coordination effort of this program could be approximately $6,000. Development of evaluation guidelines for one ordinance is estimated to range from $5,000 to $10,000 depending on the effort required in the literature survey. The time for each city, county, and special districts to review these guidelines could be donated by each agency, and the cost of modifying each ordinance or the adoption of new ordinances would vary from government to government.

Financing Mechanism. The potential sources of funds could be contributions from cities, counties, and special districts. The development of some of the model ordinances could possibly be funded by EPA as demonstration projects.

TABLE F-2

SUGGESTED LEGISLATIVE CONTROL

Sample ordinance	Implementation or review agency	Regulatory/ enforcement agency	Suggested enforcement methods
Open space requirement Slope-density requirement Natural drainage pattern requirement	County Planning Department	Planning commission approval, building department	--
Parking regulations	City, county public works	Police department	Citation and fine
Construction site erosion control	City, county public works	Building inspector	Require bond posted for erosion control
Litter control Chemical dumping control	City, county public works	Police, sheriff, public works department	Citation and fine
Septic tank maintenance Control dumping in stream channel	County health, RCDs, SCVWD, SSCVWCD	County health	Involuntary pumpout at cost of owner, compulsory cleanup at cost of owner

7. Establish Continuing Monitoring Program

Purpose. The purpose of a continuing monitoring program is to identify site specific problems, monitor the effectiveness of program implementation, assess the adequacy of monitoring efforts, identify the future plan needs, and provide a basis for plan modification as found necessary.

Action.

1. Estimate fiscal requirements and seek funds.

2. Retain contractor to conduct the monitoring programm

3. Coordinate sampling effort with ABAG, USGS, RCDs, Corps of Engineers, and SCVWD.

4. Monitor and document progress of plan implementation.

5. Review and assess effectiveness of programs implemented with each city, county, and special district.

6. Identify program deficiencies.

7. Prepare annual report on findings and make recommendations on program improvements and plan modification.

Description. The contractor retained to perform this task could be any city, county, special district, or a task force with representation from these agencies, or a private consultant.

The monitoring effort could include site specific sampling, field inspections and documentation; compilation and evaluation of information transferred by cities, counties, and special districts; assessment of program effectiveness; identification of plan deficiencies and future plan needs; preparation of annual report on status of plan implementation; and recommendations on plan modifications.

Monitoring criteria for each management practice would be established within practical limits. One example would be the number of citations issued on littering and on off-street parking. Another example might be the cubic yards of street debris cleaned by street sweepers per month.

On the completion of the draft annual report, the draft report should be distributed to each city, county, special districts, and others for review and comment. This procedure would ensure each agency's involvement in the future planning process.

A continuing monitoring process forms the basis for future planning. It should be performed on a yearly basis, preferably with the annual reports produced at the end of every fiscal year.

Cost. The cost of administration and coordination could be approximately $5,000 and the cost of the monitoring program with the preparation of an annual report could be in the range of $20,000 to $30,000 excluding the cost of participation by each agency.

Financing Mechanism. The potential sources of funds could be the contributions from cities, counties, and special districts.

APPENDIX G

IMPACT ASSESSMENT FOR SANTA CLARA COUNTY'S SURFACE RUNOFF MANAGEMENT PLAN

APPENDIX G

IMPACT ASSESSMENT FOR SANTA CLARA COUNTY'S SURFACE RUNOFF MANAGEMENT PLAN

IMPACT ASSESSMENT: ENVIRONMENTAL IMPACTS

Action	Air Quality	Water Quality	Physical Resources
Water quality monitoring		Indirect beneficial impacts through better understanding of water quality conditions and trends	
Palo Alto Flood Basin pilot project		Indirect beneficial impacts through better understanding of role of flood basin in reducing amount of contaminants reaching the Bay	
Annual report preparation		Indirect beneficial impacts	
San Jose Street Sweeping Evaluation Project		Indirect beneficial impacts through better understanding of effectiveness of current street sweeping programs	
Street sweeping		Beneficial impacts resulting from reduced amount of silt and other contaminants reaching receiving waters	
Litter control		Direct benefits from reduced amount of litter and debris reaching receiving waters	
Catchbasin and storm sewer cleaning		Beneficial impacts from reduced amounts of silt, litter, and debris reaching receiving waters	
Erosion control ordinance adoption and enforcement		Beneficial impacts from reduced erosion	Benefits from decreased loss of topsoil and vegetative cover
Dumping ordinance enforcement		Direct benefits from reduced litter and organic matter reaching receiving waters	Benefits from reduced disruption of wildlife habitat and despoilment of recreation areas

IMPACT ASSESSMENT: ENVIRONMENTAL IMPACTS (Continued)

Action	Air Quality	Water Quality	Physical Resources
Open Space zoning	Indirect benefits from reduced urban sprawl	Benefits from reduced erosion during construction	Direct benefits from reduced disruption of natural areas
Grading ordinance enforcement		Direct benefits from reduced erosion and siltation	Benefits from reduced disruption of natural areas
Stream channel maintenance		Direct benefits from reduced silt levels in stream channels	Benefits from removal of trash and debris; adverse impacts from removal of vegetation
Stream bank erosion protection		Direct benefits from reduced erosion and siltation	Impacts dependent upon type of protection used (e.g. concrete channelization might destroy wildlife habitat, whereas planting of vegetative cover on stream bank might enhance wildlife habitat)
Land management plan preparation and implementation		Direct benefits through decreased erosion and sedimentation	Direct benefits through enhanced wildlife habitat, increased land productivity, etc.
EIR guideline development		Benefits from increased awareness of potential problems and adoption of appropriate mitigating measures	Benefits from increased awareness of potential adverse impacts and adoption of appropriate mitigating measures
Oil recycling programs		Direct benefits through reduction in the amount of used oil disposed of via dumping into storm drains	
Oil recycling education programs		Benefits from reduced dumping of used oil into storm drains	
Regulating pesticide use		Benefits from reduction of amount of potentially harmful pesticides entering streams, reservoirs, and the Bay	Benefits from reduced amount of potentially harmful pesticides entering the environment
Biological control programs		Benefits from reduced levels of pesticides in streams, reservoirs, and the Bay	Benefits from reduced amount of potentially harmful pesticides entering the environment

IMPACT ASSESSMENT: ENVIRONMENTAL IMPACTS (Continued)

Action	Air Quality	Water Quality	Physical Resources
Fishing restrictions on waters with high mercury concentrations			
Local surface runoff coordinating agency creation		Benefits from improved coordination of local efforts to reduce surface runoff pollution problems	

IMPACT ASSESSMENT: ENVIRONMENTAL IMPACTS (Continued)

Action	Energy	Amenities
Water quality monitoring		
Palo Alto Flood Basin pilot project		
Annual report preparation		
San Jose Street Sweeping Evaluation Project		
Street sweeping	Some fuel consumption by street sweeping vehicles	Visual benefits from reduced silt and debris levels
Litter control		Visual amenities increased through reduced litter and debris
Catchbasin and storm sewer cleaning		
Erosion control ordinance adoption and enforcement		
Dumping ordinance enforcement		Direct benefits from reduction in unsightly dumping
Open Space zoning	Benefits from more compact development pattern in urban area and resulting travel distances	Benefits from preservation of open space areas
Grading ordinance enforcement		Benefits from reduced scarring of hillside areas
Stream channel maintenance		Benefits from removal of trash and debris; adverse impacts from removal of vegetation
Stream bank erosion protection		Impacts dependent upon type of protection used (e.g. concrete channelization might be visually sterile and unattractive, whereas planting of vegetative cover might enhance visual appearance of stream bank)

Action	Energy	Amenities
Land management plan preparation and implementation		Benefits from protection of natural landscape, prevention of overgrazing, restoration of ground cover
EIR guideline development		Benefits from reduced adverse visual impacts of development
Oil recycling programs	Benefits resulting from re-use of existing oil	Benefits from reduction of oil slicks in streams, reservoirs, and the Bay
Oil recycling education programs	Benefits from re-use of existing oil	Benefits from reduced amount of oil being disposed of in storm drains
Regulating pesticide use		
Biological control programs		
Fishing restrictions on waters with high mercury concentrations		Minor adverse impacts from reduced recreational opportunities
Local surface runoff coordinating agency creation		

IMPACT ASSESSMENT: ECONOMIC IMPACTS

Action	Production of goods and services	Income and investment	Consumer expenditures
Water quality monitoring			
Palo Alto Flood Basin pilot project			
Annual report preparation			
San Jose Street Sweeping Evaluation Project			
Street sweeping	Minor benefits in public sector employment		
Litter control	Minor benefits in public sector employment		
Catchbasin and storm sewer cleaning	Minor benefits in public sector employment		
Erosion control ordinance adoption and enforcement			Potential impacts on construction costs which may be reflected in costs to consumers
Dumping ordinance enforcement			
Open Space zoning			
Grading ordinance enforcement			Potential impacts on construction costs which may be reflected in costs to consumers
Stream channel maintenance	Minor benefits in public sector employment		
Stream bank erosion protection	Minor benefits in public sector employment		
Land management plan preparation and implementation			
EIR guideline development			

IMPACT ASSESSMENT: ECONOMIC IMPACTS (Continued)

Action	Production of goods and services	Income and investment	Consumer expenditures
Oil recycling programs	Increased employment opportunities in oil recycling	Opportunities for new business formation in oil recycling enterprises	Possible reduction in cost of recycled oil
Oil recycling education programs			
Regulating pesticide use	Possible minor impacts on the production of particular pesticides		
Biological control programs			
Fishing restrictions on waters with high mercury concentrations			
Local surface runoff coordinating agency creation			

IMPACT ASSESSMENT: SOCIAL IMPACTS

Action	Housing supply	Physical mobility	Health & safety
Water quality monitoring			Indirect benefits from identification of potential health problems related to water quality
Palo Alto Flood Basin pilot project			
Annual report preparation			
San Jose Street Sweeping Evaluation Project			
Street sweeping		Minor impacts on traffic flow from slow moving street sweeping vehicles	Reduction in safety hazards to bicycle riders due to broken glass and other such objects on roadway
Litter control			Benefits to health and safety from removal of litter
Catchbasin and storm sewer cleaning			Benefits from reduced flood hazard
Erosion control ordinance adoption and enforcement			Benefits from reduced erosion and siltation which reduce stormwater carrying capacity of culverts and storm drains and thus increase flood hazards
Dumping ordinance enforcement			Benefits to public health and safety from control of dumping of trash and garbage
Open Space zoning	Reduced opportunity for scattered urban development; possible increase in housing costs from reduced amount of land available for development	Indirect impacts through prevention of urban sprawl	Benefits to health and safety by preventing or reducing development in potentially hazardous areas
Grading ordinance enforcement			Benefits to public safety by preventing grading which might lead to landslides

IMPACT ASSESSMENT: SOCIAL IMPACTS (Continued)

Action	Housing supply	Physical mobility	Health & safety
Stream channel maintenance			Benefits to public safety by removing silt and debris which might otherwise increase hazard of flooding by impeding flow of stormwaters
Stream bank erosion protection			Benefits to public safety by reducing undercutting of streambanks adjacent to homes
Land management plan preparation and implementation			Benefits from reduced erosion and siltation of streams and flood control channels
EIR guideline development			Benefits from increased awareness of potential health and safety problems
Oil recycling programs			
Oil recycling education programs			
Regulating pesticide use			Benefits to public health from restrictions on use of potentially hazardous pesticides
Biological control programs			Benefits to public health from reduced use of pesticides, herbicides, and insecticides
Fishing restrictions on waters with high mercury concentrations			Benefits to public health by preventing human consumption of fish containing higher than normal levels of mercury
Local surface runoff coordinating agency creation			

IMPACT ASSESSMENT: SOCIAL IMPACTS (Continued)

Action	Equity	Urban patterns
Water quality monitoring		
Palo Alto Flood Basin pilot project		
Annual report preparation		
San Jose Street Sweeping Evaluation Project		
Street sweeping		
Litter control		
Catchbasin and storm sewer cleaning		
Erosion control ordinance adoption and enforcement		
Dumping ordinance enforcement		
Open Space zoning	May make residential development in non-urban areas more costly, thus reducing opportunities for economically disadvantaged to live in such areas	Helps prevent urban sprawl and thus encourages more compact urban pattern
Grading ordinance enforcement		
Stream channel maintenance		
Stream bank erosion protection		
Land management plan preparation and implementation		
EIR guideline development		
Oil recycling programs		
Oil recycling education programs		
Regulating pesticide use		

IMPACT ASSESSMENT: SOCIAL IMPACTS (Continued)

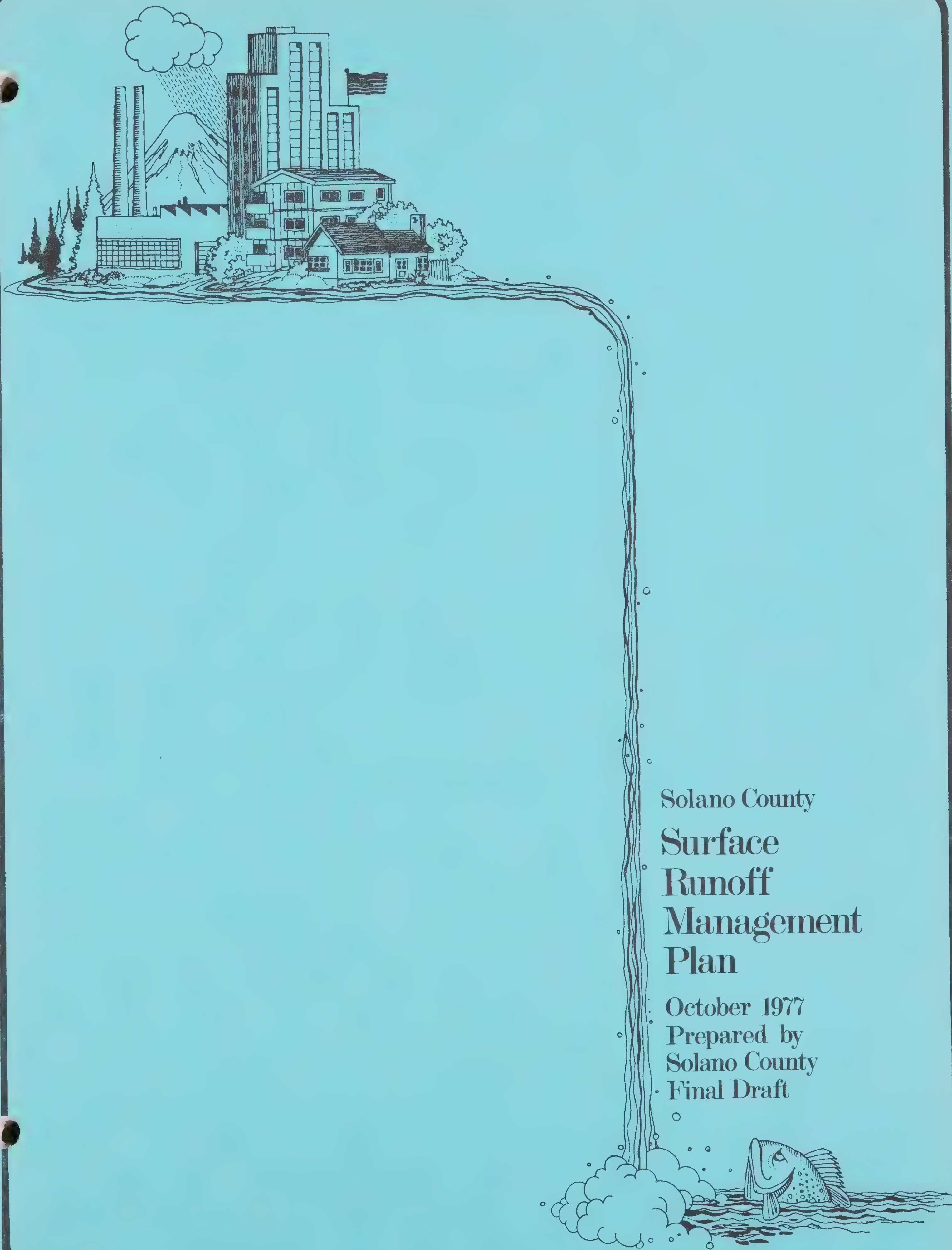
Action	Equity	Urban Patterns
Biological control programs		
Fishing restrictions on waters with high mercury concentrations		
Local surface runoff coordinating agency creation		

IMPACT ASSESSMENT: INSTITUTIONAL AND FINANCIAL IMPACTS

Action	Costs to public	Costs to local governments	Institutional impacts
Water quality monitoring		Local agencies are currently spending more than $637,000 annually	
Palo Alto Flood Basin pilot project		Cost not currently known	
Annual report preparation		Cost not currently known	
San Jose Street Sweeping Evaluation Project		Cost $80,000 (EPA grant)	
Street sweeping		Local agencies currently spending more than $1,819,300 annually	
Litter control		Local agencies currently spending more than $109,600 annually	
Catchbasin and storm sewer cleaning		Local agnecies currently spending more than $555,200 annually	
Erosion control ordinance adoption and enforcement	May involve costs to individuals and firms involved in construction or other activities affected by the ordinance	Costs of ordinance preparation, adoption, and enforcement not currently known	
Dumping ordinance enforcement		Costs to local governments not currently known	
Open Space zoning		Costs associated with administration of ordinances not known	
Grading ordinance enforcement	May involve costs to those needing grading permits	Total costs of enforcement not known	
Stream channel maintenance		Combined costs of stream channel maintenance and streambank erosion protection more than $429,000 annually	

IMPACT ASSESSMENT: INSTITUTIONAL AND FINANCIAL IMPACTS (Continued)

Action	Costs to public	Costs to local governments	Institutional impacts
Stream bank erosion protection		See note immediately above	
Land management plan preparation and implementation	Costs to individuals implementing land management plans currently $400,000 annually	Local expenditures currently more than $40,000 annually	
EIR guideline development		Costs to develop EIR guidelines not currently known	
Oil recycling programs		Local agencies are currently spending more than $1,000 annually	
Oil recycling education programs			
Regulating pesticide use		Costs not known	
Biological control programs		Costs not known	
Fishing restrictions on waters with high mercury concentration			
Local surface runoff coordinating agency creation		Cost not yet known	Will depend upon specific organizational structure established



Solano County

Surface Runoff Management Plan

October 1977
Prepared by
Solano County
Final Draft

FINAL DRAFT
SOLANO COUNTY
SURFACE RUNOFF MANAGEMENT PLAN

October 1977

The preparation of this report was financed in part through an area-wide waste treatment management planning grant from the Environmental Protection Agency, Region IX, under the provisions of Section 208 of the Federal Water Pollution Control Act as amended.

Prepared jointly by

Solano County Planning & Public Works Departments

with the assistance of

Water Resources Engineers, Inc.

Table of Contents

List of Figures

List of Tables

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I. INTRODUCTION

A. PREFACE

The Problem

A recent major concern, nationally and locally, has been for the declining quality of the surface waters. Because of water quality deterioration, human health has been jeopardized. Many water bodies are no longer safe for recreational uses; wildlife habitats have been threatened; shellfish beds and crab populations have been contaminated; and the frequency of fish kills has increased.

Past efforts to control water pollution have generally focused on industrial and urban wastes. These are contaminants carried through a pipe system and are called "point sources" because they are concentrated at identified locations.

Other forms of water pollution not so easily identified are called "non-point" sources, of which Surface Runoff is a principal contributor. Pollutants are washed across the surface of the land into rivers, lakes and other water bodies. These surface runoff pollutants and problems can include the following: (1) siltation and turbidity resulting from erosion of soil and other materials from the natural landscape and construction projects, (2) contamination of aquatic life and elimination of recreational uses due to bacterial contamination from faulty septic tank leach fields or pet and farm animal wastes, (3) unsightly appearance of waters caused by the presence of oil, grease, paints and other liquids, (4) low concentration of dissolved oxygen, harmful to aquatic life, caused by the addition of natural organic material like leaves and grass, fertilizers from both farm and home use and industrial runoff.

Legal Mandate

To control the nation's water pollution problems (especially non-point sources) the United States Congress passed the Federal Water Pollution Control Act Amendments of 1972. Two of the main objectives of the Act are: (1) that the discharge of pollutants into the nation's navigable waters be eliminated by 1985, and (2) that swimmable and fishable waters be achieved wherever possible by 1983. To help facilitate these objectives, Section 208 of the Act specifically calls for designated area plans which will control water pollution resulting from surface runoff or other non-point sources.

The Environmental Protection Agency (EPA) is responsible for meeting these goals and standards and EPA, through the State of California, has delegated

this responsibility locally to the Association of Bay Area Governments (ABAG), which is a regional planning agency for the nine Bay Area counties.

Under the direction of EPA, State and Regional agencies, ABAG with the assistance of a $4.3 million grant, is formulating a comprehensive Environmental Management Program. Problems which are being studied in addition to surface runoff are: (1) air quality, (2) municipal wastewater point sources, (3) industrial wastewater, (4) non-point sources other than surface runoff, (5) solid waste, and (6) water conservation, reuse and supply.

Local Participation

Each county assists in the formulation of the seven plans through membership on the Environmental Management Task Force (EMTF) and each of the Management Plan's Technical Advisory Committees. For preparation of the Surface Runoff Plan, however, ABAG chose to contract with the nine Bay Area counties. This action was taken to encourage the widest possible participation in the Management Plan which could have the greatest impact upon local communities. The contract award for preparation of the Surface Runoff Plan locally is $58,000. To further assist the county in the technical preparation of the Report, a private engineering consultant firm was selected, Water Resources Engineers, Inc. During preparation of the plan the county participated, along with other Bay Area counties, in a number of Technical Workshops sponsored by ABAG, and received a considerable amount of resource material and technical data from that agency.

Review Process

Following a review of this Draft Plan by the Local Surface Runoff Management Technical and Citizens Advisory Committees, affected local cities and agencies, and the public, the Board of Supervisors transmitted a Final Draft Plan to ABAG in October 1977. Local plans will be integrated into the Regional Plan and combined with the six other management plans by April of 1978. At this time, the ABAG General Assembly will vote upon adoption of the Regional Environmental Management Plan. Each member Government will have one vote in the General Assembly. Following adoption by the General Assembly, the Regional Environmental Management Plan must then be reviewed and approved by the State and the Federal Government.

Administration of the Plan

The Environmental Management Plan will be administered on both the Local and Regional level. Locally each affected city, agency and the county will be asked to carry out recommendations of the Local Plan. Regionally the Association of Bay Area Governments, using the Regional Surface Runoff Management Plan for guidance, will be responsible for the review of local projects under the A-95 Federal Grant Review process. This screening process will indicate whether a proposed federal grant project or action is in conformance with the adopted Regional Environmental Management Plan.

In addition to ABAG, the San Francisco Regional Water Quality Control Board (SFRWQCB) will administer any discharge permits in compliance with the Regional Surface Runoff Management Plan.

B. GOALS AND OBJECTIVES

Goals

The Solano County Surface Runoff Management Plan has two main goals:

1. To preserve and enhance the water resources available to Solano County, so as to permit maximum use and enjoyment of these waters, through a healthful environment, for both man and animal or aquatic life.

2. To reduce the maximum amount of surface runoff pollutants entering the county streams, lakes, marsh wetlands, and other water bodies utilizing control measures which are economically, socially, environmentally and politically acceptable to the people of Solano County.

Objectives

1. Identify and evaluate existing and future problems and prepare alternative control measures, assessing their effectiveness and feasibility.

2. Encourage local cities and agencies to become fully aware of available surface runoff control measures and to implement those measures most feasible for reducing surface runoff pollution.

3. Promote a public education program which will identify the problems and causes of pollution from surface runoff and which makes the public aware of actions they can take to reduce the problems.

4. Create arrangements and agreements that will provide administrative direction and funding for the management of a surface runoff program.

5. Provide for a continuing planning process to allow for continued refinement and updating of the Surface Runoff Management Plan.

II. GENERAL DESCRIPTION OF THE PLAN

Solano County's Surface Runoff Management Plan consists of seven measures for the control of surface runoff, and the institutional, financial, legislative, and scheduling details for plan implementation. The Plan also contains provisions for the establishment of a Surface Runoff Section that will administer the Plan and carry out a continuing planning program to further investigate problems and possible solutions thereto, and to periodically review and update the Plan. Presented here are brief descriptions of the seven initial control measures and the continuing planning program.

Improve Street Sweeping Practices

Pollutants that accumulate on street surfaces have been shown to contain many polluting substances that surface runoff waters can wash off into sewers, streams, and receiving waters where the pollutants can have adverse impacts on water quality. The effectiveness of street sweeping in removing pollutants can be improved. The Plan recommends the funding of a $20,000 demonstration project (75 percent of which would come from an EPA grant) to study the effects of various street sweeping improvements on the quality of surface runoff waters from urban lands. With the results from this project, guidelines for improving the efficiency of sweeping operations will be prepared by the County Surface Runoff Section and implemented by the local public works departments. Finally, to prevent the unnecessary entry into receiving waters of pollutants from off-street paved surfaces, flushing (hosing) of materials from sidewalks, driveways, parking lots, etc. will be prohibited. The measures will require the cooperation of the cities in passing and enforcing ordinances and in carrying out recommended sweeping guidelines. The total cost over the first two years will be approximately $22,700.

Control Chemicals

The improper use of toxic chemicals, particularly for pest control, can lead to the contamination of surface runoff waters. Applications for agricultural purposes are currently well regulated by the County Agricultural Commissioner. This control measure consists of a public education program aimed at home users of chemicals, and a study to identify critical habitats that may be impacted by existing chemical applications. The work will be carried out jointly by the Surface Runoff Section and the Agricultural Commissioner. The entire program will take place over a year and a half and cost about $2,600.

Control Direct Discharges

Several substances that are occasionally dumped directly into storm drainage facilities have potentially serious water quality impacts. These substances include used motor oil, solvents, paints, pesticides, detergents, and organic matter such as grass and leaves. In order to minimize this avoidable source of pollution, the Surface Runoff Section will investigate the feasibility of an oil recycling program and initiate a public education program to explain the adverse consequences of dumping into storm drains. The cost will be $4,500 spread over a two year period.

Improve Septic Tank Controls

Improperly functioning septic tanks and leach fields can cause pollutants to come to the ground surface where they can enter water bodies through the storm runoff process. Solano County currently maintains septic tank criteria for new installations and inspects existing tanks in the rural areas of the county. The Plan calls for a review of existing criteria for conformance to recent model codes and possible code modifications. Also, the Health Department will coordinate with and advise the Surface Runoff Section as to the progress of the inspection program. The cost of this measure is projected to be about $1,000 annually.

Control Catchbasins

Many older catchbasins include sediment traps which collect settled materials from urban runoff. This can lead to contaminated stagnant water and associated odors, insects, and pollution of the initial storm runoff flow through the catchbasins. Although there are potential advantages to sediment-trap catchbasins in certain cases if they are properly maintained, the disadvantages probably outweigh them. This measure calls for a continuation of present catchbasin practices: maintain existing catchbasins, eliminate sediment traps, and minimize the installation of new catchbasins with sediment traps. This program will be carried out by the cities and county agencies and special districts currently performing these functions at an estimated cost of $7,500 per year.

Control Erosion

Erosion of soil from agricultural and construction activities presents a potentially very serious threat to receiving waters in Solano County. Increased turbidity, sedimentation, and pollutant delivery due to erosion can have impacts on streams, marshes and bays. The Plan therefore includes several actions to identify and control the activities which may lead to excessive erosion. First, the Soil Conservation Service and the County Public

Works Department will work together to identify critical erosive areas and applicable control methodologies. An erosion control program will be formulated as a combination of regulatory measures and a voluntary program supplemented by education, technical assistance and cost-sharing. The cities and county will be asked to establish erosion control ordinances to regulate the erosion producing activities of urban construction. Lastly, the cities and county are requested to specifically address erosion control in all Environmental Impact Assessments. The major effort will take place in the first two years at a cost of about $8,500.

Control Land Use

Land use controls are institutional actions which affect the intensity of the use of land. These actions can have major beneficial effects on the quantity and quality of runoff as well as on public health, safety and general well-being. The Plan calls for the cities and the county to adopt creekside ordinances to protect riparian habitats from development directly adjacent to waterways. The County Planning Department will examine current agricultural parcel sizes and practices for compatibility with Suisun Marsh protection, and coordinate land use activities with Napa County, which also contains sensitive marshlands. Finally, the cities and county, within the forum of the Technical Advisory Committee, will explore and share experiences related to new concepts in subdivision design that will decrease runoff and associated pollution. The major activities will be completed within two years at an estimated cost of $5,300.

General Administration And Continuing Planning Program

A six-year continuing planning and administration program will be established to perform several on-going functions. These include administration of the Plan, development of additional information, review of findings, periodic reporting of progress and plan updating. The specific program will consist of staffing a Surface Runoff Section within the County Public Works and Planning Departments, continuing to conduct meetings of the Technical Advisory Committee (representatives from several city and county agencies and special districts) and the Citizens Advisory Committee, implementing an on-going water quality monitoring program, implementing a continuing public education program, reviewing the findings of other surface runoff management agencies and the EPA, and preparing periodic reports and program updates. The costs for the first two years will be about $43,400, mostly for monitoring and time spent by the Technical Advisory Committee. The annual cost thereafter will be about $12,400. The total cost for the entire plan will be $39,500 for the first year, $62,800 for the second year (includes $20,000 demonstration project), and approximately $21,000 per year for the last four years.

III. CHARACTERISTICS OF THE AREA

A. GENERAL DESCRIPTION OF SOLANO COUNTY

Area and Location

Solano County has a total area of 898 square miles of which 823 square miles is land and 75 square miles is water area. An area approximately 350 square miles is in the ABAG 208 study area which includes most of the southern half of Solano County.

The county is located between the San Francisco Bay Area and the Sacramento Valley. The eastern edge of the California Coast Range makes up its western border and the Sacramento River the eastern border. The Putah Creek forms the northern boundary, and Suisun and San Pablo Bays, which are inland extensions of the San Francisco Bay, form the southern boundary of the county. Because of the extensive frontage on the bays, the county is considered as one of the nine San Francisco Bay Area counties.

Population

In September of 1975, a state special census was conducted within Solano County. The total population at that time was 187,744, and of that total, 173,257 lived within incorporated cities and 14,487 within the unincorporated portion of the county. Within the 208 ABAG study area the total population is approximately 142,000.

Geographic and Hydrographic Characteristics

The western portion of Solano County extends into the Coast Range foothills to maximum elevation of 2,819 feet above sea level. This western area is generally characterized by steep slopes. From the foothills, the northern portion of the county extends easterly onto the flat Sacramento Valley floor with the southern portion extending easterly onto the Sacramento-San Joaquin Delta Marsh area and the rolling Montezuma Hills. With the exception of these low rolling hills in the southeast corner, the valley lands are level or gently sloping alluvial plains. They rise from near sea level along the eastern and southern borders to an elevation of approximately 100 feet at the edge of the foothills. At the county's south end, the Suisun Bay tidal flats and marshlands lie adjacent to the Sacramento River. These lands contain more than 80 square miles, or 9 percent of Solano County's total area, and are separated into a number of islands by natural or manmade drainage channels. There is also a small marsh area in the extreme southwestern corner of the county, the Napa Marsh.

The inland portion of the county contains no major rivers. A number of intermittent creeks originate in the Coast Range Mountains or foothills. They flow easterly onto the main valley floor toward the Sacramento River or the marsh area, carrying mostly storm water runoff. Most of the creeks or channels flowing toward the Sacramento River become extinct before they reach the river.

Climate

Solano County has a mild, two-season climate that is typical of the Central Valley of California. A warm, dry season usually extends from May through October. A cool, wet season usually occurs from November through April. Periods of relatively high daytime temperatures frequently occur in summer, but the nights are generally cool. Clear skies predominate throughout the year although night and early morning fog sometimes occurs in winter. Rain constitutes practically all precipitation. Snowfall is rare on the valley floor and even in the Coast Range Mountains the amount of snowfall is very small. Total annual precipitation increases from 17 inches in the southeastern portion of the county to near 25 inches at Vacaville, to near 40 inches at Mt. Vaca which is on the west county line at 2,819 feet elevation.

The average January temperature is about 45°F; the July average is about 76°F; and the mean annual temperature is about 60°F. The average frost-free season is approximately 260 days. Winds are generally from the west and southwest with a higher velocity in the south-central and southeastern portions. In the area of the Suisun Marsh and continuing easterly toward Rio Vista, the mean hourly wind velocities exceed 15 miles per hour.

B. STUDY AREA

ABAG 208 Study Area

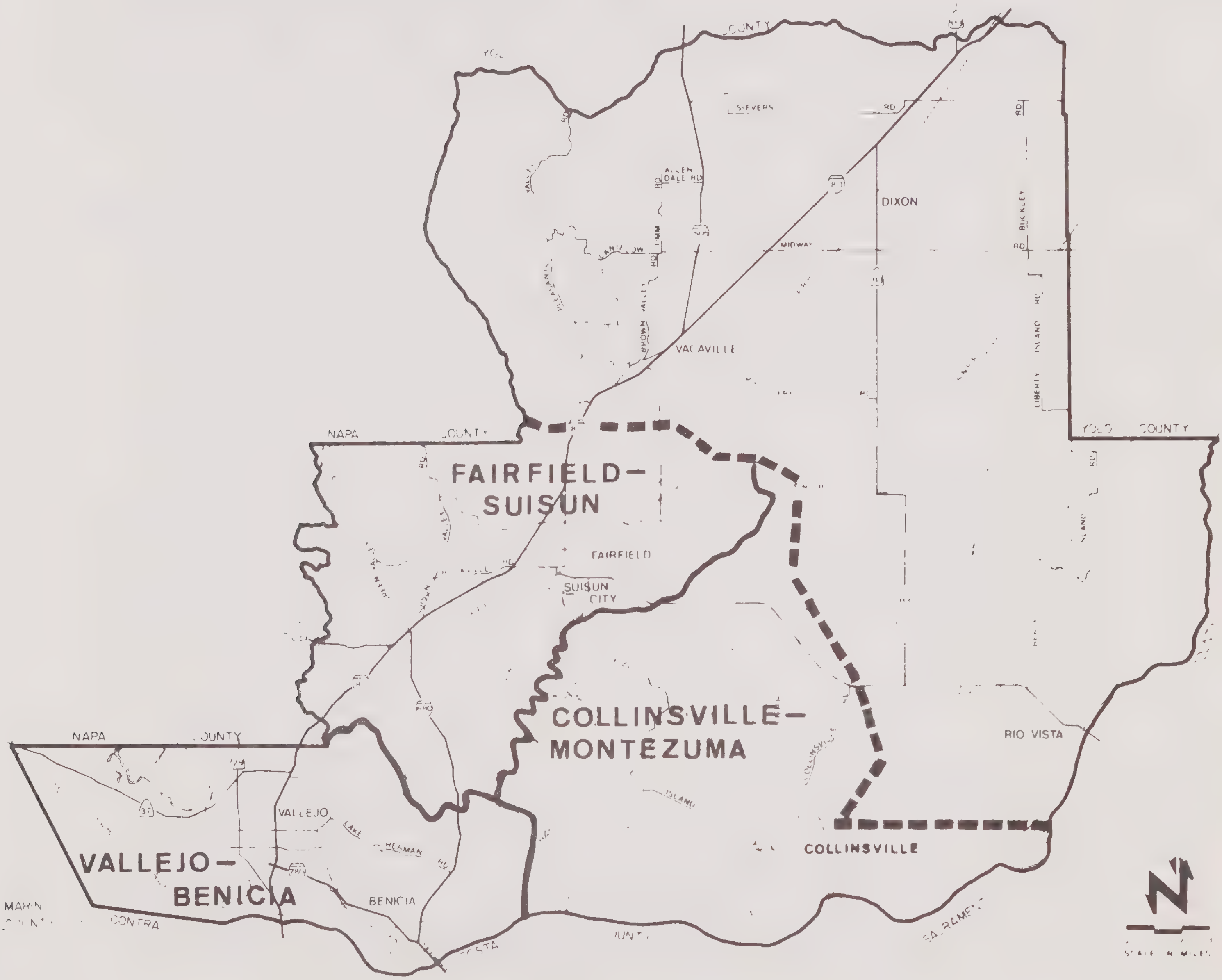
Only the southern portion of Solano County lies within the area affected by the ABAG 208 Environmental Management Program (Figure 1). This is due to the fact that drainage from the northern portion of the county does not directly flow into the San Francisco Bay or any of its inland bays. The northern portion of the county is within the State of California's non-designated 208 area. A plan for this area will be prepared by the State.

The southern portion of Solano County which lies in the ABAG 208 study area has been broken into three watersheds for analysis purposes (Figure 1). These watersheds are: (1) Vallejo-Benicia, (2) Fairfield-Suisun, and (3) Collinsville-Montezuma Hills.

Current Land Use of the Study Area

Following is a more detailed description of each of the three study area watersheds.

SOLANO COUNTY SURFACE RUNOFF MANAGEMENT PLANNING AREA



LEGEND

ABAG 208 STUDY AREA ---

WATERSHED AREAS ——

Vallejo-Benicia

With 45,000 acres, this is the smallest and most urban of the three watersheds. In addition to the cities of Vallejo and Benicia, notable features include the Mare Island Naval Shipyard, the Napa Marsh and the hills north of Benicia. This watershed drains into Suisun Bay, Carquinez Straits and San Pablo Bay. Total residential land use is estimated at 5,300 acres with over 90 percent devoted to single family dwelling units. Commercial land uses occupy approximately 1,200 acres and industrial uses 2,000. The Vallejo-Benicia watershed contains 36,000 acres of open lands, most of which are devoted to grazing.

Fairfield-Suisun

This watershed, which drains into the Suisun Marsh, is the largest of the three with approximately 90,000 acres. Fairfield and Suisun City are the principal urban centers, although some rural residential growth has taken place in the Green Valley Area west of Fairfield. Travis Air Force Base is a notable institutional feature in the area east of Fairfield. Physical features which help define the watershed are Cement Hill north of Fairfield, the Vaca Mountains to the west, and a portion of the Suisun Marsh to the south and east.

Residential land uses occupy approximately 3,600 acres with 95 percent devoted to single family dwellings. Commercial and industrial uses are estimated to utilize 930 and 870 acres respectively; the largest proportion of watershed land, 78,400 acres, is devoted to open space. Most of the open space component is comprised of hilly lands used for grazing. Other substantial portions are devoted to intensive agriculture in the Suisun Valley, and to marsh related uses.

Collinsville-Montezuma Hills

This watershed, which drains into the Suisun Marsh and the Sacramento River, is the most rural of the three. Of a total of 87,000 acres, approximately 100 are used for residential purposes, 90 acres for industrial, and 1 acre for commercial use. In addition to scattered farm dwellings and duck clubs, residences are located near the small unincorporated communities of Birds Landing and Collinsville. Of the remaining open space uses, approximately 42,000 acres are in the Suisun Marsh. The rest of the area consists of rolling hills and flat lands for grazing and dry land farming.

The Future of Solano County

The ABAG Series III projections indicate that Solano County will experience substantial population increases through the year 2000. Provisional 1990 figures project an increase of 159,357 to a county population total of 345,617, representing a percentage increase of 85.6 percent over the county's 1975 population of 186,260.

In comparison with the above figures, the Solano County Transportation Council 1990 Goal Future projection foresees a population of 312,000. This recently completed projection has undergone extensive review by city and county policy bodies and staff, and represents the best local projection of future growth.

If past local policies continue in force, the majority of all projected growth will take place in the incorporated cities where public services are provided. Figures from the Transportation Council Goal Future projections indicate that Suisun City will experience the most dramatic growth with a 643 percent increase from 3,275 in 1975 to 24,350 in 1990. Benicia is expected to grow from 10,754 to 20,150, an 87 percent increase. Vallejo is expected to reverse its recent trend of losing population and show an increase from 70,642 to 96,000. Fairfield is projected to increase by 34 percent growing from 50,497 in 1975 to 67,800 in 1990.

Projected Land Uses for the Study Area

Following are land uses for each of three watershed areas as projected to the years 1985 and 2000.

Vallejo-Benicia

Although considerable growth is projected for this watershed between now and 1985, the most substantial land use changes will be experienced by the City of Benicia. The Southampton residential subdivision should be fully developed, occupying the rolling hills between I-680 north to Lake Herman Road. Development of a new waterfront marina and park, adjacent to the Carquinez Straits should also be completed. Moderate development will take place around the City of Vallejo to the northeast, east and southeast. The Napa Marsh and remaining hill areas should retain their present open space character.

By the year 2000, most residential development in Benicia should be completed, moderate development should continue in Vallejo. Some expansion of the Benicia Industrial Park could take place. The hill area north of Benicia (Sky Valley) should continue to be undeveloped due to slope and geologic restraints.

Fairfield-Suisun

This watershed will experience rapid residential development through the year 1985. The City of Suisun is projecting an increase of 6,420 dwelling units by 1985. Residential development will also take place to the northeast and west of Fairfield with some possible residential and commercial development to the southwest in the Cordelia area. The remaining lands should remain in open space or retain their rural character with the exception of some rural residential estate development in the Green Valley-Rockville area.

From the years 1985 to 2000, residential development in Suisun should almost be completed. Future development of the Cordelia area should occur, adding approximately 15-20,000 new people to the City of Fairfield. Industrial development could occur in the vicinity of Travis Air Force Base.

Collinsville-Montezuma Hills

Little residential-commercial development is anticipated through the year 1985 or 2000. However, a major industrial growth could take place adjacent to the Sacramento River depending on regional, state and federal regulations governing air and water quality maintenance.

IV. EXISTING AND POTENTIAL PROBLEMS

The need for a surface runoff management plan is based on the existence of problems caused by surface runoff. A substantial amount of effort was therefore spent in trying to identify these problems in Solano County. Emphasis was placed not only on detecting existing problems, but also on predicting possible future problems based on what is forecast to occur in Solano County. In view of the complexity of surface runoff and related water pollution problems, the following sections describe the nature of these problems, followed by the results of the problem identification efforts.

A. NATURE OF SURFACE RUNOFF PROBLEMS

Sources of Pollutants

As rain falls on the land and flows to and through the drainage system (streets, pipes, ditches, channels, rivers, etc.) to the receiving water body (lake, estuary, bay, ocean) it picks up material from the surfaces it flows over. The nature of these materials depends on the type of surface and use the surface is being put to. For example, in cities, large areas are paved or otherwise made impervious to the vertical movement of water through the surface. Litter, garbage, animal wastes, soil particles, metal particles, sand and gravel, leaves or other plant matter, and oil and grease are among the materials that accumulate on these surfaces from various sources. The amount and composition of these urban loads varies and can be very different in the business district, industrial area, and residential neighborhood because of the difference in the activities that take place. In pervious (i.e. allowing water to pass through) areas such as parks, open and agricultural areas, the nature of the material carried off by runoff is much different. To a large extent, it consists of the soil itself, which is loosened by the impact of the rain and carried away in suspension. The extent to which this happens is dependent on many factors including the composition of the soil, the nature of the vegetal cover and the slope or steepness of the land. In the case of agricultural areas, however, substances such as chemical fertilizers and pesticides may enter the runoff. In grazing areas, animal wastes may be a significant constituent of runoff. In residential areas served by septic tanks, improper operation can expose human wastes to the runoff. Therefore, man's activities on land have a great impact on the nature of the water entering receiving water bodies during rainy periods.

Because of the way in which these materials are generally spread out over large areas, surface runoff is classed as a non-point source as opposed to the discharge from a municipal or industrial plant through a pipe directly

into a water body, which is termed a point source. This study concerns itself with surface runoff, but comparisons will be made with point sources, which, often result in similar problems, but lend themselves to very different forms of control.

Surface Runoff Pollutants

The use of the word pollution has been largely avoided in this discussion until now. A substance usually becomes a pollutant when it is present because of man's activities and causes changes that are in some sense undesirable. We turn now to a closer look at the particular pollutants in surface runoff and the undesirable effects they may have. Surface runoff pollutants can be classed as solids, organics, nutrients, bacteria, heavy metals, and floatables.

Solids may be suspended or dissolved, but the suspended solids are of more concern in surface runoff. Suspended solids are readily observable as "dirty water" and may consist of small particles of soil or other matter. They are particularly important since many other pollutants are often attached to these particles. All runoff contains some suspended solids, even in natural, undisturbed areas. Problems occur when the amount of suspended solids become very high due to poor construction or agricultural practices which expose loose soil to rain and subsequent runoff. Apart from their role as carriers of other pollutants, the solids themselves can damage a water body by several means. They make the water more turbid (muddy), so that light cannot penetrate as far. This can have profound effects on plant and animal life. When some of the solids settle out in still waters, the bottom becomes covered with silt, smothering vegetation and creating habitats for bottom dwelling organisms, which generally are less desirable in an ecologic sense. Siltation also has the undesirable effects of reducing the capacity of reservoirs and clogging streams, leading to increased flooding.

Organics are materials derived from living matter, such as plants and animal wastes. When these organics decay through natural processes, they consume oxygen that is dissolved in water. The term "biochemical oxygen demand" or BOD, is used to quantify the oxygen depleting capacity of organic matter in water, and thus its potential for causing disruptions in aquatic ecosystems. Sufficiently low oxygen levels that result from high organic loads can make it difficult or impossible for fish and other water life to survive. The decaying of organic matter also results in the production of nutrients such as nitrogen which in turn can cause problems.

Nutrients are substances such as nitrogen and phosphorus that are needed for plant growth. The introduction of nutrients in the form of agricultural fertilizers or decayed organic matter can lead to excessive plant growth and algal "blooms", and resultant eutrophication. This has a destabilizing effect on the ecosystem and can be unsightly and create foul odors as well.

Bacteria are an essential part of the ecosystem and are present in great numbers in any non-sterile water. The problem related to bacteria is the presence of certain forms of disease-causing bacteria in great numbers. This

is generally caused by the introduction of fecal matter (from animals and humans) which is very high in these bacteria. Fecal coliform bacteria are often used as an indicator of the presence of harmful bacteria, although they are, in themselves, harmless. High bacterial levels can make water unsafe for drinking and water contact recreation, and can also contaminate aquatic life, especially shellfish.

Heavy metals such as lead, zinc, copper and chromium are present in very small amounts in surface runoff relative to other substances. They are often found in urban runoff due to sources such as gasoline (lead), automobiles, and industrial activities. Pesticides contain various heavy metals and are often found in runoff from agricultural areas. Heavy metals, even in small amounts, are toxic to animals. They differ from most other pollutants in that they are persistent or non-degradable. This means that they can accumulate in the body tissue and contaminate higher life forms such as fish and aquatic birds, having serious effects on these organisms and making them dangerous for human consumption.

Floatables include oil, grease and litter. Litter is aesthetically unpleasant and may carry other pollutants. It is common in urban runoff, particularly from busy commercial streets. Oil and grease is also unsightly, but is furthermore toxic to aquatic life and restricts water-related recreation. It is generated from automobile related activity such as the dumping of oil into storm sewers and the spilling of oil and grease onto impervious surfaces.

B. PROBLEMS IDENTIFIED IN THIS STUDY

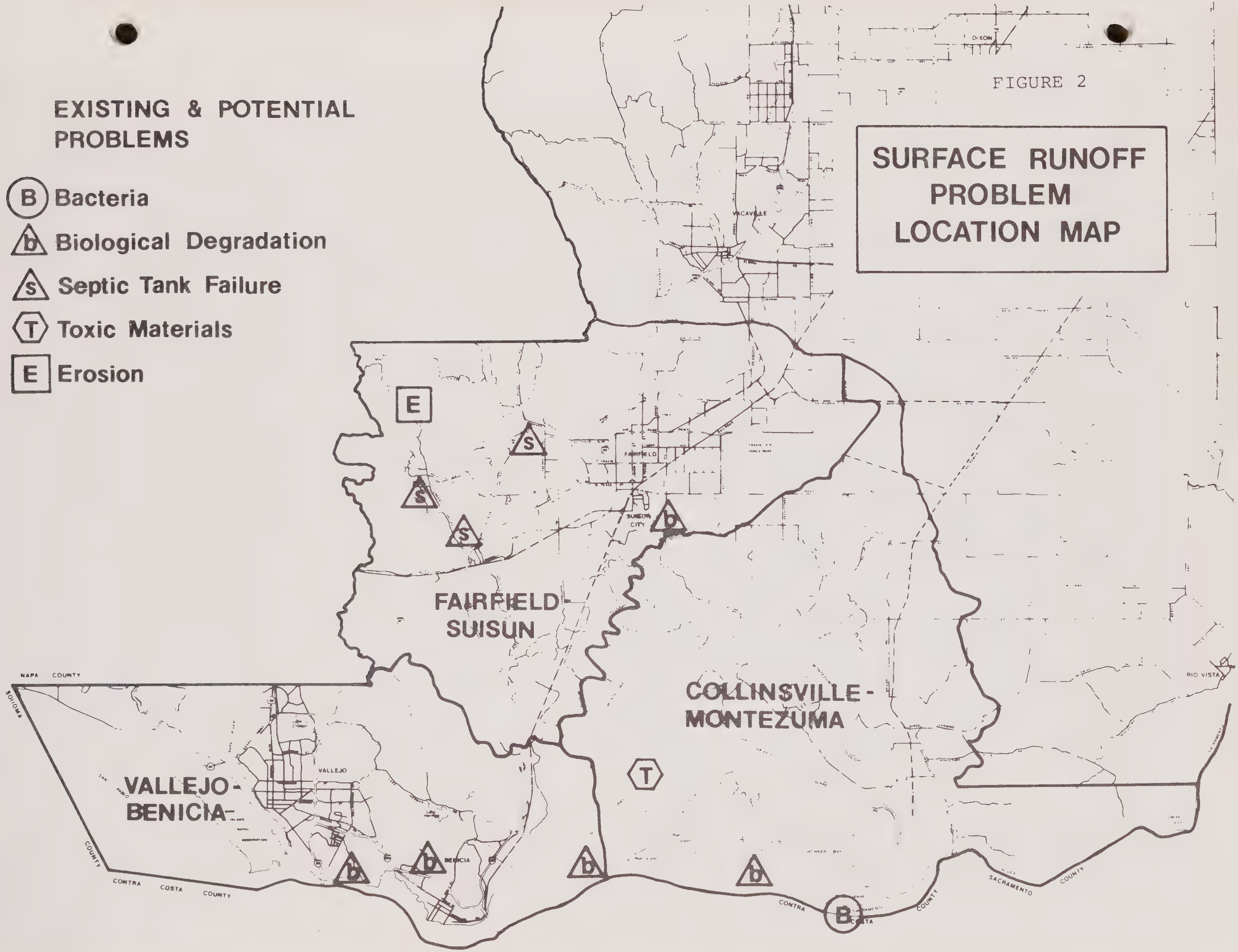
Several methods were used in this study to identify surface runoff problems. These included reviewing past studies and available data, questioning local agency personnel, conducting field surveys, monitoring water quality in one stream, and computer modelling. Details of these efforts can be found in Appendices A, B, and C. The findings of the ABAG Surface Runoff Management staff, and of the other counties participating in the regional plan development process were also useful.

Because of their very nature, surface runoff problems are very difficult to pinpoint as to extent and source. The loadings can occur over short storm periods, making measurements difficult. The effects of non-point and point sources often cannot be separated, inputs from the Sacramento San Joaquin Delta also must be considered. The immediate and long-term effects of sudden "shock loadings" in particular locations on the extremely complex ecosystems of Suisun Marsh and Bay, San Pablo Bay, and the Sacramento River are very difficult to evaluate or predict. Forecasting future conditions is educated guesswork at best. Therefore, while some problems were detectable, tracing them back to particular surface runoff related causes was generally not possible.

Figure 2 shows some of the water quality problems that were uncovered. The

FIGURE 2

SURFACE RUNOFF PROBLEM LOCATION MAP



absence of problems from large areas should not be interpreted to mean that there are no problems in these locations. Rather, it is more likely that no sampling or observations of problems in those areas took place. The large number of identified problems in Suisun Bay is indicative that the extensive amount of sampling that has taken place there allowed them to be detected. Also, the presence of a problem on the map does not imply that it is wholly or even inpart caused by surface runoff from Solano County. Problems in Suisun Bay, adjacent to the Carquinez Straits, for example, are not thought to be mainly caused by Solano County runoff. Description of the problems that were identified as existing or potential follows, organized by source.

Septic Tanks

While specific incidents of failure have not been reported in recent years, the Green Valley, Rockville, and Tolenas areas are served by septic tanks. These pose the potential problem of the surfacing of waste leading to the introduction of organics and bacteria into Suisun Marsh. Forecasted increases in development in these and other low density areas will compound the problem.

Agricultural Operations Including Livestock

A preliminary field survey of Green Valley Creek conducted by an ABAG staff member indicated some siltation likely due to erosion caused in part by agriculture and overgrazing. While the extent of the problem in other areas of the county has not been determined, this is a major potential source of pollution, as documented by sampling programs in other locations. The substantial use of pesticides and fertilizers in the county is also considered a potential problem.

Urbanization

Data from previous sampling in Fairfield supports the data collected throughout the county which indicates high organic and nutrient loads and suspended solids. The Fairfield data also showed high pesticide concentrations which may have originated from urban applications. The presence of other problems associated with urban development that have been observed in other parts of the Bay Area and throughout the country and which should be considered potential problems, are heavy metals from industrial areas and oil and grease from automobile related activites.

Construction Activites

No sampling data from construction sites was available in Solano County, but it is known that such activity can generate suspended solids concentrations as much as 2000 times natural levels. In view of the projected rapid growth of certain portions of the county, this must be considered a potential problem.

Point Sources

The MAC model was used to project total loadings due to surface runoff from Solano County assuming Bay Area average runoff quality data gathered as part of the regional sampling program (Appendix C). These loadings were compared over an average year to point loads from municipal and industrial waste discharges. The findings were that suspended solids come almost entirely from surface runoff (mostly from open areas), but that organics and nutrients originate mainly from point sources. In general, for Solano County, the point source loads were two to three times greater than surface runoff loads for nutrients and organics at present, but planned future treatment facilities will reduce organic loads from point sources to below surface runoff levels and advanced treatment may eventually reduce nutrient levels as well. Appendix C contains more details on these findings.

For reasons already stated, and also due to a lack of sampling data, the identification of problems in Solano County was not very precise. From what is known about surface runoff in general and from what has been observed here and throughout the country, it can be concluded that Solano County has few surface runoff problems, none of which are considered major. It can also be concluded that there is potential for future problems as Solano County continues to grow. What we know about surface runoff problems is sufficient, however, to tell us what may be done to minimize harmful impacts associated with present practices and future growth.

V. TECHNICAL APPROACH

This section briefly describes the technical approach that was used to develop the surface runoff management plan. Details on all noted tasks are contained in Appendices A through D.

A. DATA BASE

All hydrologic and water quality data relevant to surface runoff in Solano County were assembled and organized. The data included precipitation, streamflow, and water quality sampling records. This data base was used to help identify problems and provide input data for the computer modeling program. It is anticipated that it will be of use in the continuing planning process as well. Appendix A contains the details on the data base.

B. PLAN DEVELOPMENT METHODOLOGY

The Environmental Management Task Force adopted a seven step approach for the development of the Surface Runoff Management Plan. Briefly, these steps are:

1. Determine all reasonable possibilities for controlling pollution from surface runoff (candidate control measures).

2. Identify the factors that should be considered in assessing the appropriateness of control measures.

3. Determine what problems are being caused by surface runoff. Identify pollutants, their sources, quantities and effects.

4. Refine the list of candidate control measures based on the problem analysis. Develop alternative management programs.

5. Assess these regional alternatives with respect to environmental, social, economic, financial, and institutional criteria.

6. Evaluate and select from among the alternatives to develop the management plan.

7. Describe a continuing process of data collection and evaluation.

This approach was used to develop this plan. The work done on steps 3 through 7 are documented in this report. Steps 1 and 2 were carried out by ABAG.

C. COUNTY-WIDE SURVEY OF PROBLEMS

Part of the problem identification effort included a review of past studies relevant to surface runoff in Solano County, oral and written comments from representatives of county agencies, and the assembling and review of hydrologic and water quality data. Details on these activities are in Appendix A.

D. MONITORING PROGRAM

A monitoring program was implemented on Green Valley Creek to collect data on the quality of surface runoff. The results of this sampling program were used to help identify the extent of local problems and were combined with the results of similar programs by other Bay Area counties to characterize the surface runoff from a variety of land uses. The combined results served as input to the computer modeling program which was used to predict future levels of pollution. Solano County's monitoring program and its results are described in Appendix B.

E. MODELING PROGRAM

Two computer models, MAC and SWMM, were available to analyze the present and future problems due to surface runoff. The models are also capable of providing information that can be used to assess the effectiveness of alternative measures for the control of surface runoff. The models were not used for that purpose, however, due to limitations in the data used to calibrate the models. Descriptions of both models and a summary of data collection and results are found in Appendix C.

F. DEVELOPMENT OF CONTROL ALTERNATIVES

The process whereby the control measures included in the plan were developed and other potential measures excluded consisted first of an examination of current problems and surface runoff practices being used by various agencies in Solano County. A preliminary review and assessment of several candidate control measures followed. A plan was drafted and reviewed by the Solano County Surface Runoff Management Technical Advisory Committee (TAC). The present control measures were developed from modifications to this draft plan.

Table 1 lists each candidate control measure considered for inclusion in the plan along with an indication (yes, no, or maybe) of whether that measure will be applied in the plan.

If maybe is indicated, the measure is noted along with a brief explanation of why the measure was not definitely chosen. If no, a short statement

about why the measure was rejected is given. More information on the procedures used to select control measures is included in Appendix D.

The measures not selected tend to fall into distinct categories. Some measures were rejected because they do not address a significant problem that applies to Solano County. In other cases, the potential problem being addressed was felt to be under adequate control at present. In two cases, the measure was too indirectly related to surface runoff quality (with benefits primarily in other areas) to be appropriate for inclusion in a surface runoff plan. A large number of measures are listed as "not cost-effective." These measures, while they may be appropriate and effective in highly urbanized locations, are not as appropriate for Solano County, which is largely rural. While some of these controls could improve the quality of runoff from certain urban portions of the county, they were found to be inferior from a cost-effectiveness viewpoint to those measures which address the larger areas and potential problems of the county.

TABLE 1
ASSESSMENT OF CONTROL MEASURES

Control Measure	Will Measure Be Applied in Plan?	Comments
1. Provide more frequent street cleaning.	maybe	Dependent on further study.
2. Provide more efficient methods of street cleaning.	yes	
3. Repair streets.	no	Felt to be inappropriate for a surface runoff plan: primary benefits not related to water quality.
4. Control certain chemicals.	yes	Home use.
5. Restrict auto parking.	maybe	Dependent on further study.
6. Control use of lots and streets.	no	Not a significant problem.
7. Control dumping.	no	Not a significant problem.
8. Control littering and dog droppings.	no	Adequate litter controls exist.
9. Control automobile and other emissions.	no	Felt to be inappropriate for a surface runoff plan: primary benefits not related to water quality.
10. Control direct discharge of pollutants.	yes	
11. Clean storm water collection system.	yes	
12. Replace cross connections of sewerage systems.	no	Not a significant problem.
13. Insure proper operation of septic tanks and leach field.	yes	

TABLE 1 - Continued

Control Measure	Will Measure Be Applied in Plan?	Comments
14. Develop slope density standards.	maybe	Dependent on further study.
15. Maintain open space areas.	maybe	Dependent on further study.
16. Control development patterns.	maybe	Dependent on further study.
17. Develop buffer strip requirements.	maybe	Dependent on further study.
18. Control roof drains.	no	Not cost effective.
19. Construct rooftop detention and storage.	no	Not cost effective.
20. Rechannel runoff to prevent flow over critical surfaces.	maybe	Dependent on further study.
21. Redesign curb and gutter configurations.	no	Not cost effective.
22. Remove debris in channels, pipes, and inlets to improve flows.	no	Adequately controlled.
23. Regard disturbed areas.	yes	
24. Reseed or apply vegetative cover to bare slopes.	yes	
25. Stabilize channels of rivers and streams.	no	Adequately controlled.
26. Control erosion at construction sites.	yes	
27. Regulate construction schedules to avoid concentration of activities in time and space.	yes	

TABLE 1 - Continued

Control Measure	Will Measure Be Applied in Plan?	Comments
28. Construct permanent berms for critical sources.	maybe	Dependent on further study.
29. Use of energy dissipators to reduce potential for erosion or transport of solids.	no	Adequately controlled.
30. Increase perviousness of surfaces.	maybe	Dependent on further study.
31. Require minimum amount of pervious surfaces for new construction.	maybe	Dependent on further study.
32. Use efficient tillage and plowing practices for agricultural areas.	yes	
33. Modify drainage basin.	no	Not cost effective.
34. Measures to treat and store runoff.	no	Not cost effective.

VI. SURFACE RUNOFF MANAGEMENT PLAN

Solano County's Surface Runoff Management Plan consists of several measures for the control of surface runoff, along with the institutional, financial, legislative, and scheduling details necessary for implementation. Table 2 summarizes the key elements of the plan.

Following Table 2 the plan is described in four sections. In Section A the control measures recommended for immediate implementation are described in some detail, including consideration of the measures' applicability, effectiveness, and costs. Present practices in Solano County are reviewed in addition to the presentation of recommended actions. Also included is a summary of the assessment of the environmental, economic, social, and institutional/financial impacts of each proposed measure (Table 3). Section B deals with the arrangements for establishing a continuing planning program and some of the on-going activities that will be performed. Section C outlines specific costs necessary to implement the recommended control measures, and Section D indicates when they are scheduled to be carried out. A more detailed assessment of each control measure is presented in Appendix E of the supporting document.

A. RECOMMENDED CONTROL MEASURES

Improve Street Cleaning Practices

Summary Description

This measure involves the use of brush-type street sweepers or vacuum units to clean street surfaces. Also considered under this measure are the use of high-velocity low-volume sprays of water for flushing streets and the use of both techniques for cleaning surfaces adjacent to streets (parking lots, sidewalks, driveways, gas stations, etc.) by government agencies, commercial and industrial organizations, and individuals.

Studies have shown that material found on streets and other impervious surfaces typically contain high levels of pollutants, including suspended solids, BOD, nutrients, and in some cases bacteria, heavy metals and oil. As a result of sweeping or flushing, litter and particulates are removed from surfaces and are therefore not available to become incorporated into the surface runoff during a subsequent storm, thereby yielding a less adverse effect on receiving waters.

TABLE 2

SURFACE RUNOFF MANAGEMENT PLAN SUMMARY

PROBLEM	RECOMMENDED CONTROL MEASURE POLICY	ACTION	IMPLEMENTING AGENCY	SCHEDULING ACTIONS	LEGAL AUTHORITY	FINANCING MECHANISM
Administration and continuity of plan	A. General Administration and Continuing Planning Program	1. Staff a Surface Runoff Section in Public Works and Planning Department	County Planning & Public Works	July 1978	Board of Supervisors	Department Funding
		2. Continue the Surface Runoff Management Technical Advisory Committee (TAC)	Surface Runoff Section	July 1978	Board of Supervisors	Department Funding
		3. Retain the Surface Runoff Management Citizens Advisory Committee (ad hoc)	Surface Runoff Section	July 1978	Board of Supervisors	Department Funding
		4. Implement a continuing water quality monitoring program	Surface Runoff Section	1978	County	EPA & County
		5. Initiate a continuing public education program	Surface Runoff Section	July 1978	County	County
		6. Review findings of other Surface Runoff Management agencies and the EPA	Surface Runoff Section	July 78-84	County	County
		7. Prepare periodic reports	Surface Runoff Section	Annually	County	County

TABLE 2 Continued

PROBLEM	RECOMMENDED CONTROL MEASURE		IMPLEMENTING AGENCY	SCHEDULING ACTIONS	LEGAL AUTHORITY	FINANCING MECHANISM
	POLICY	ACTION				
Presence of pollutants on street surfaces, including solids, nutrients, organics, oil and grease, and heavy metals	B. Improve street sweeping practices	1. Conduct a street sweeping demonstration project	City of Fairfield & Surface Runoff Section	July 1979	City	EPA, County Fairfield
		2. Prohibit flushing of materials from impervious surfaces	Cities	1980	Cities	---------
		3. Establish guidelines for improving street sweeping effectiveness	Surface Runoff Section & Cities	1979	Cities, County	County
Presence of harmful chemicals in surface runoff	C. Control chemicals	1. Identify critical habitats and potential impacts of chemicals	Agricultural Commissioner & Surface Runoff Section	1980	County	County
		2. Initiate a public education program aimed at home users of chemicals.	Surface Runoff Section & Agricultural Commissioner	1979	County	County
Dumping of crankcase oil and other harmful substances into storm sewers	D. Control direct discharges	1. Investigate an oil recycling program	Surface Runoff Section	1978	County	County
		2. Initiate a public education program on the consequences of direct dumping	Surface Runoff Section	1979	County	County

TABLE 2 Continued

PROBLEM	RECOMMENDED CONTROL MEASURE POLICY	RECOMMENDED CONTROL MEASURE ACTION	IMPLEMENTING AGENCY	SCHEDULING ACTIONS	LEGAL AUTHORITY	FINANCING MECHANISM
Potential for surfacing of organic wastes and entry into surface runoff	E. Improve septic tank controls	1. Review and modify septic tank criteria	Health Dept.	1978-79	County	County
		2. Monitor the septic tank inspection program	Health Dept. & Surface Runoff Section	1979-84	County	County
Accumulation and decomposition of matter in catchbasins and subsequent "first flush" pollutant loading	F. Control catchbasins	1. Minimize installation of new catchbasins	County & Cities	1978	Cities & County	---------
		2. Monitor and maintain existing catchbasins	County, Cities & Special Districts.	1978	Cities, County & Special Districts.	County, Cities & Special Districts
		3. Implement catchbasin elimination programs	County & Cities	1978	Cities & County	County & Cities
Excessive erosion and resulting turbidity and siltation due to agricultural and construction activities	G. Control erosion	1. Identify critical areas and applicable controls	TAC, SCS & Surface Runoff Section	1978	County & SCS	County & SCS
		2. Implement erosion control program	SCS & County Public Works	1978-79	County & SCS	County & SCS
		3. Establish erosion control ordinances	County and Cities	1979	County & SCS	County & SCS
		4. Require erosion control considerations in Environmental Impact Assessments	County and Cities	1978	County	---------

TABLE 2 Continued

PROBLEM	RECOMMENDED CONTROL MEASURE		IMPLEMENTING AGENCY	SCHEDULING ACTIONS	LEGAL AUTHORITY	FINANCING MECHANISM
	POLICY	ACTION				
Organic loadings and siltation resulting from erosion	H. Control land use	1. Adopt creekside ordinances	County Planning & SCS	July 1979	Cities & County	County & SCS
		2. Examine agricultural practices	County Planning & SCS	July 1979	County	County & SCS
		3. Apply subdivision design review	TAC & Surface Runoff Section	1978-1984	County & 4 Cities	County & 4 Cities
		4. Coordinate land use activities with Napa County	County Planning & Surface Runoff Section	1978-1984	County	County

Applicability and Effectiveness

This control measure is most applicable in urbanized (e.g. residential, commercial, and industrial) areas or other areas which have high loading intensities on impervious surfaces. Street flushing is most applicable where the surfaces are smooth and drain to an area of accumulation for removal.

An example of removal efficiencies for a mechanical sweeper making one pass over a street is: 54 percent removal of total solids, 40 percent of BOD, 40 percent of Kjeldahl nitrogen, 20 percent of phosphate, 40 percent of pesticides, and 28 to 49 percent of various heavy metals. The lower efficiencies for certain pollutants are tied to their association with the finer particles sizes, which are not efficiently removed by conventional sweepers (which are designed to remove larger particles primarily for aesthetic purposes). The vacuum-type sweepers have been shown to be significantly more effective in the fine materials (up to 90 percent removal), although more testing is needed to fully assess the effectiveness of such units in practice. Less is known about the effectiveness of flushing methods, but estimates of 60-90 percent removal have been made. An additional problem with flushing is that the flushed materials must somehow be collected and disposed of. This is seen as a major drawback. One solution is to allow the flush flow with its load to enter the combined sewer system and be treated along with sanitary flows. This solution is not possible in Solano County cities as all have separated sanitary and storm sewers.

The actual effectiveness in practice of a street-cleaning program is reduced by such factors as parked cars (less of a problem for flushers), poor machine condition, and lack of operator training. The relationship between the quality of runoff from urban surfaces and the number of days since the streets were cleaned or washed clean by a previous storm has been very difficult to define. The rate of pollutant buildup appears to be very rapid initially and reach a maximum level after only a few days. The unexpected finding has led to speculation as to whether street materials are even the primary source of pollutants in urban runoff. The actual effectiveness of a street cleaning program in terms of how it affects urban runoff quality has not been documented at this time.

Present Practices

All major Solano County cities in the study area now employ conventional street sweepers on a regular basis. No vacuum units or flusher trucks are currently used. The frequency of cleaning varies with the land use type. In the central business district (CBD) and commercial areas, sweeping takes place from almost every day to once or twice a week. In residential areas, once a month is typical. Parking restrictions are generally enforced in the CBD of all cities.

The effect of these current practices on runoff quality cannot be estimated in quantitative terms. However, it is unlikely that sweeping residential

areas once a month has any significant effect when the storms occur at much more frequent intervals. On the other hand, daily sweepings in the CBD are probably very effective in improving runoff quality from these areas. A monitoring program would be required to quantify the effect.

Flushing on a small scale occurs in residential areas (driveways, sidewalks) and commercial areas (storefronts, gas stations) for aesthetic purposes. The usual result of such actions is to flush surface pollutants from these surfaces and from street gutters into the storm sewers and channels, insuring they will reach the receiving waters and making them inaccessible to other cleaning efforts.

Recommended Practices

1. Conduct a street sweeping demonstration project

In order to assess the potential value of more intensive street sweeping efforts and the use of better equipment, a demonstration project should be conducted in a small urban watershed as part of the continuing planning process. By collecting samples of runoff from this urban watershed, the effects of various sweeping strategies can be tested, including more frequent sweepings, use of vacuum units, and parking bans. The project should be staged over several storms allowing for enough sampling on which to base a city-wide plan.

2. Prohibit flushing of materials from impervious surfaces

This would apply to residential, commercial and industrial flushing, as well as street cleaning by anyone other than the street maintenance departments. This measure will have the dual effect of reducing pollutant loadings (by encouraging removal of materials that would otherwise enter the storm drainage system) and conserving water. Flushing of streets by street maintenance departments should be retained as a street cleaning option since it can be an effective way of removing some pollutants. However, flushing must be carried out so that the material washed up from the streets is prevented from entering drainage facilities and is instead picked up and hauled away.

3. Establish guidelines for improving street sweeping effectiveness

These guidelines will initially be based on what is known about sweeping effectiveness and later updated as the demonstration project yields results or more information becomes available through studies by other agencies. The objective is to make the agencies responsible for sweeping streets aware of how improvements can be made from a water quality standpoint. These guidelines would include such items as:

- gradually replacing older sweepers with vacuum units
- increasing efforts during the wet season
- regulating parking in areas to be swept
- training operators
- adjusting equipment to collect smaller particles
- making more than one sweeping pass
- operating sweepers at slower speeds

Cost Considerations

The costs involved in implementing these recommendations would be minimal except for the demonstration project funding. A modest project is estimated to cost $30-40,000, but may be eligible for a 75 percent grant from EPA. If this study recommends the purchase of more sweepers (vacuum units) or increased sweeping efforts, the costs could be significant. The following cost information should be considered:

Capital costs

3-wheel mechanical:	$23,000 to $33,000 per sweeper
4-wheel mechanical:	$35,000 to $45,000 per sweeper
vacuum sweeper:	$38,000 to $50,000 per sweeper

Mechanical costs
for conventional sweepers: $2/curb mile

Total program costs
$16 per cu. yd. of material collected
$18 per ton of material collected
$4 to $5 per curb mile (including labor)

Costs of current local practices

Vallejo:	6,500 curb miles/yr:	$30,000	$4.60/curb mile
Fairfield:	12,700 curb miles/yr:	$72,000	$5.70/curb mile
Benicia:		$ 9,000	
Suisun City:		$18,000 (1975)	

These figures are rough estimates only. Furthermore, the Fairfield data on cost per curb mile is based on assumptions concerning the breakdown of commercial and industrial land uses. Also, the costs per curb mile may not be directly comparable because no standard accounting practices were used to determine them.

Control Chemicals

Summary Description

The use of chemicals should be controlled to minimize their introduction into the aquatic ecosystem. The most important element in minimizing chemicals in surface runoff concerns the manner in which the chemicals are actually applied. The use of chemicals in and around drainage facilities for pest and weed control almost certainly results in the introduction of chemicals into the aquatic ecosystem. Extreme care should be exercised in such operations to insure that the least harmful chemicals that will perform the intended function are used and that alternative measures are used when possible (e.g. weed control by discing rather than chemicals). An area too often overlooked is the application of chemicals around the home. Presently there is no Governmental agency which regulates this type of use.

Applicability and Effectiveness

Controls of chemicals are appropriate for Solano County due to the extent of agricultural operations which depend on chemicals for crop production and pest control. The effectiveness of the control measures will range from very high to low depending on the control measures employed. The best way to minimize the adverse impacts of chemicals is through good user certification and educational programs.

Present Practices

There is provision for the control of agricultural chemicals in Solano County through the State's Department of Food and Agriculture Code. Locally these regulations are administered by the Solano County Agricultural Commissioner's Office. The Agricultural Commissioner has the authority to issue citations to individuals who violate sections of the code. The Agricultural Commissioner may also adopt regulations which are supplemental to those of the State Code which govern the conduct of pest control operations and records and reports on each operation. However, pesticides used by individual homeowners, for structural pest control and for industrial and institutional purposes, are not under the control of the Agricultural Commissioner.

Recommended Practices

The sale, use and management of chemicals in Solano County for agricultural purposes is well regulated by the California Food and Agricultural Code through the State Department of Food and Agriculture and the County Agricultural Commissioner. As indicated previously, the areas not covered by the Agricultural Commissioner include the use of chemicals in and around homes, for structural pest control, and for industrial and institutional purposes. If the code and regulations are adhered to in Solano County it appears that controls on chemicals for agricultural uses should be quite effective. However, consideration should be given to chemical control around the aquatic environment and an urban application education program.

1. Identify critical habitats and potential impacts.

In the continuing Surface Runoff Management Planning Program, important and critical aquatic habitats should be identified and historical and anticipated usage of chemicals for agricultural purposes which could impact those areas should be reviewed. The purpose of this review would be to formulate, if required, special local controls on chemicals to provide full protection to aquatic habitats. In addition, this review should assist in pointing out key areas that should be included in any water quality monitoring program to be carried out in the future.

2. Implement a public education program aimed at home users of chemicals.

A public education program in the proper use of chemicals in and around the home should be implemented. Even though there are precautions printed on the labels of chemicals designed for home use, an educational program would help to inform the public of the environmental consequences of using chemicals and provide additional guidelines for their proper use or even alternatives to the use of chemicals.

Cost Considerations

Cost considerations associated with the recommendations on the control of chemicals would involve the identification of critical habitats and a public education program.

Control Direct Discharges

Summary Description

This measure consists of programs to prevent the direct dumping of pollutants into the storm sewers. Such pollutants include waste motor oil, solvents, paint, pesticides, detergents, grass clippings, weeds, or leaves. The pollutants to be controlled contain either toxic substances or organic matter (which can lead to depressed dissolved oxygen in receiving waters). Preventing these pollutants from entering the storm drainage system through direct dumping control will reduce their accumulation prior to runoff and subsequent entry into receiving waters where they impact beneficial uses.

Applicability and Effectiveness

This measure is most applicable in areas where direct dumping is most common. The extent of dumping of any substance in a given area is difficult to determine and, at best, is based on observations of and familiarity with local practices. The effectiveness of regulations against such activities may be low because enforcement is virtually impossible. Public awareness of the impacts of dumping can help, but the most effective control would be to provide the individual with a reasonable alternative that is environmentally sound. It is, however, impossible to give any meaningful quantitative estimates of effectiveness before the measure has been implemented and, in some cases, even afterward.

Present Practices

All the cities in the study area have programs to pick up and dispose of leaves and grass clippings. There are not oil recycling or public education programs aimed at reducing direct dumpings.

Recommended Practices

1. Investigate an oil recycling program

The experience gained by other agencies that have set up such programs (e.g. San Jose) should be tapped. Also, the present status of proposed state legislation on oil recycling should be checked. It is anticipated that the program would be carried out in conjunction with local service stations and would be accompanied by a public education and publicity campaign to seek the support of local civic groups.

2. Initiate a public education program on the consequences of direct dumping.

The aim of this program would be to increase public awareness of the consequences of direct dumping of pollutants into storm drains by working with local civic groups.

Cost Considerations

The major costs of the recommended program would be administrative expenses associated with the operation of recycling and pickup operations, including a public education program. However, cost of an oil recycling program may be partially offset by the sale of the re-used oil.

Improve Septic Tank Controls

Summary Description

Criteria for septic tanks should ensure that septic tanks and leach fields are properly installed in new developments. In addition, periodic inspections will assist in determining if the systems are operating properly. Specific criteria normally include a definition of percolation tests, soil profiles to be taken, minimum setback requirements, drainfield requirements, septic tank requirements, distribution system requirements, lot size requirements, and inspection and maintenance requirements.

Applicability and Effectiveness

Septic tank criteria are applicable to Solano County since septic tanks are currently installed in the Green Valley and Tolenas areas and continued low density residential development is expected in the future. The effectiveness of septic tank criteria is generally good especially with respect to ensuring that systems are properly installed. In Solano County, no significant problems with septic tanks have been reported in the ABAG 208 Study Area. So, the criteria have apparently been effective in minimizing septic tank related water quality problems.

Present Practices

Solano County presently maintains septic tank criteria which include detailed specifications for all of the items indicated above. It is of interest to note that Solano County criteria require inspection of installations both immediately after construction and every five years thereafter in lots smaller than 10 acres.

Recommended Practices

1. Review and modify septic tank criteria

The septic tank criteria should be reviewed and compared to recommendations contained in recent model codes and manuals. If more stringent criteria are indicated by recent information, Solano County should consider modifying its criteria.

2. Monitor septic tank inspection program

The County Health Department should keep the continuing Surface Runoff Management Planning personnel informed as to the progress and results of the inspection program.

Cost Considerations

Review and modification of existing criteria and monitoring of inspections would involve the expenditure of time by administrative personnel. It is not expected that the hiring of new personnel would be required. If inspections should increase greatly in frequency as a result of strict enforcement, the costs could be significant.

Control Catchbasins

Summary Description

This measure involves the control of pollutants which accumulate in catchbasins and result in the contamination of runoff and other problems, including objectionable odors and insect breeding habitats. The term catchbasin refers to an inlet that includes a sediment trap. The control takes the form of periodic cleaning of catchbasins, elimination of existing sediment traps by filling them in, and the installation of inlets with no sediment traps in new developments. The objective of this measure is to reduce or eliminate the accumulation of pollutants in catchbasins prior to runoff, so that they will not enter the drainage system and subsequently the receiving waters and impact beneficial uses. Elimination of breeding areas for mosquitos will also reduce this nuisance and the need for direct applicatin of pesticides into catchbasins.

Applicability and Effectiveness

This measure applies to all urban areas that have catchbasins, but particularly to those areas known to accumulate solids rapidly. These areas are usually easy to identify on the basis of complaints and frequent requests to clean the catchbasins.

Catchbasins present the unique situation of being both potentially helpful and harmful to water quality. If properly designed and maintained, they can be quite effective in trapping medium to coarse particles and preventing them from entering the drainage system. However, harmful pollutants have been found to be associated with the fine fractions, and these are simply passed through the catchbasin. When the sediment trap becomes more than half full, the removal efficiency becomes very poor and the result is that solids (and contaminated liquids) are released at the start of a storm, creating a "first flush" pollution load.

A catchbasin cleaning effort that keeps the level of accumulated solids at less than half the storage depth can have substantial benefits to water quality. Although the usefulness of catchbasins as pollution control devices is marginal, the first-flush loading will be reduced, and the removed solids will not enter the receiving waters, or settle out downstream in the drainage system.

The use of inlets with no sediment traps and the filling in of existing sediment traps (conversion to inlets) have the advantages of eliminating the first-flush pollution, reducing maintenance costs, and eliminating other problems associated with catchbasins (e.g. odors, mosquitos, application of pesticides). A drawback is the need to increase sewer cleaning if transporting deficiencies exist downstream from filled in sediment traps, since materials that settled in the sediment trap may be deposited elsewhere in the system. If not, they will be deposited in the receiving water, which could present a sediment problem, although not necessarily a water quality problem.

Present Practices

All Solano County cities currently clean most of their catchbasins. Fairfield cleans the 70 remaining catchbasins that have not yet been converted to inlets one or twice a year. Vallejo has eliminated, or plans to do away with almost all of its catchbasins. Benicia cleans all of its catchbasins each year before the rainy season. Suisun City has converted all but about 25 of their catchbasins into inlets. Fairfield's program is estimated at $10,000, while Vallejo estimates $5-$50 for a catchbasin, depending on its condition.

Recommended Practices

1. Minimize installation of new catchbasins

Where storm sewers are being installed, inlets without sediment traps should be used whenever possible. Catchbasins at key locations or at the downstream end of the system may be desirable to prevent the deposition of coarse sediments in the pipes or receiving waters. These catchbasins

should be properly designed for maximum effectiveness and maintained such that they never become more than half full. Where downstream storage facilities are to be built, the need for catchbasins may be eliminated altogether.

2. Monitor and maintain existing catchbasins

The cities should monitor the present condition and rates of accumulation of solids in existing catchbasins and revise cleaning schedules if necessary, to prevent the sediment traps from becoming more than half full. The required frequency may vary widely in different areas.

3. Implement catchbasin elimination programs

Where no downstream transport deficiencies or excessive coarse sediment loads are experienced, existing catchbasins should be filled in with concrete to convert them to simple inlets. This effort may be staged over a few years if it is desired to observe the results of initial conversions before proceeding to eliminate all unnecessary catchbasins. This will reduce the need for periodic cleaning and application of pesticides to control mosquitos. Odor problems will also be reduced.

Cost Considerations

The costs of installing inlets will be lower than that of placing catchbasins. The monitoring and revision of cleaning schedules will result in some minor administrative costs, but the actual cost of the revised cleanings is unknown and will depend on the results of the monitoring findings and the number of catchbasins that are filled in. It is expected that the filling in of existing catchbasins will result in a net savings over the long run due to reduced cleaning costs. The following are estimated costs for maintenance and filling:

$5-$50/catchbasin for cleaning
$100/catchbasin for filling in

Cost savings may also be realized through reduced need for Mosquito Abatement Control.

Control Erosion

Summary Description

Erosion control measures fall into one of three broad categories: vegetative, mechanical, and structural. Vegetative practices include the use of both natural ground covers, such as grasses, shrubs and trees, and artificial covers such as mulches, jute mats and chemical additives which provide temporary soil stability while permanent vegetative cover is established.

Mechanical control practices refer to those mechanical field practices to control erosion by conveying concentrated overland flow away from erodible areas. Examples include (1) surface roughening such as scarification along a contour of a graded slope (the scarified grooves spread the runoff

horizontally and slow the downhill movement), (2) gradient and level terraces, (3) interceptor dikes (dikes placed across rights-of-way to intercept and divert runoff onto a vegetated area or into a disposal structure), and (4) level spreaders (bench cuts into the hillside with the forward edge, or lip, constructed exactly level which will allow the water to spill out over the downhill slope as non-erosive sheet flow).

Structural measures are used for land stabilization, stream flow regulation, and water and sediment storage. In contrast to vegetative and mechanical control techniques which are normally used in upland sediment-source areas, structural measures are usually deployed at downstream points in a drainage system to reduce either sediment load or stream flow at that point. Structural controls commonly in use include: (1) reservoirs; (2) stream channel improvements and stabilization works; (3) debris and sedimentation ponds; and (4) levees, dikes, floodways, and floodwater diversions.

Applicability and Effectiveness

Erosion control measures of all three general types may be applied to Solano County. Construction and agricultural activities in Solano County are the major causes of soil erosion. Erosion control at construction sites can be most effectively accomplished by requiring an erosion control plan to be submitted with plans for development. It has been reported that soil loss from major construction sites can be reduced by 90 percent through the implementation of good erosion control practices. Erosion control practices recommended by the Soil Conservation Service can be effective in agricultural operations.

Present Practices

At the present time there is no specific requirement for developers in Solano County to control erosion at construction sites. Vallejo, however, does have erosion control guidelines. The Soil Conservation Service (SCS) through the three Resource Conservation Districts in Solano County, provides conservation, technical and advisory assistance to landowners and operators whose property is located within a district. Resource Conservation District assistance which affects the control of pollution includes the following major elements:

(1) Public Information and Education Assistance: Informing and educating the public about resource management through the media, schools, civic forums, and other organizations.

(2) Inventory and Evaluation Assistance: Providing basic inventory data such as soil surveys, vegetative information, and other technical data and interpretations and evaluations of these data.

(3) Planning Assistance: Providing technical assistance to land users in determining alternative land uses and treatment needs and assisting in development of a conservation plan reflecting the specific land use and treatment decisions.

(4) Application Assistance: Providing technical assistance to cooperating land users to help them install planned conservation practices which include engineering and vegetative measures. Assistance may include site investigations, designs and specifications, construction plans, layout of practices, and supervision of installation.

The U.S. Department of Agriculture, through the Agricultural Conservation Program (ACP) will cost-share eligible practices, applied by the landowner or operator, up to 50 percent of the cost and with a limit of $2,500 per farm annual (present limitations).

The Solano Irrigation District requires all farmers discharging irrigation return waters into the District's drainage system to control on-farm and channel erosion so that their return waters contain a minimum of suspended and/or settleable solids.

Recommended Practices

1. Identify critical areas and applicable controls.

Solano County, through the Surface Runoff Management Technical Advisory Committee, in cooperation with the Solano County Association of Resource Conservation Districts should perform a study to identify, inventory and evaluate existing and potential erosion problem areas within rural portions of Solano County. Using the publication entitled "Handbook of Best Management Practices" dated October 1977 and prepared and distributed by the Council of Bay Area Resource Conservation Districts, the TAC should also determine applicable agronomic, managerial, and structural practices used singly or in combination to reduce erosion to a level compatible with Water Quality goals on the identified areas.

2. Implement erosion control programs.

Upon completion of the identification phase, some form of a regulatory program could be formulated. This may be in the form of regulatory measures, a voluntary approach, or a combination of the two. Conservation Districts have had good success with a voluntary program involving education, technical assistance, and a cost-sharing in controlling most sources of non-point pollution; however, regulatory measures may be needed in some cases. For the program to be most effective, remaining rural and agricultural lands excluded from Conservation Districts, may be included or annexed into one of the three existing Resource Conservation Districts. The following is an example of a possible voluntary program:

(1) Assign leadership for the effort to the state soil conservation agency at the State level and to the conservation districts at the local level.

(2) Develop a strong education and information program through the State Extension Service, enlisting the aid of all interested agencies, groups, and organizations and focusing on the designated non-point source problem areas.

(3) Provide the necessary technical and cost sharing assistance commensurate with the need to meet target abatement dates.

(4) Provide for a monitoring program designed to track progress and to evaluate program effectiveness on a periodic basis.

3. Establish erosion control ordinances.

Solano County, and all cities and agencies, should strengthen the regulation of clearing, grading and construction activities relating to urban development. Ordinances should be enacted by each agency that would set forth specific actions to be taken, such as requiring a permit, preparation of a clearing and grading plan that includes erosion control measures, and a work schedule. Performance standards and penalties for non-compliance should also be included in the ordinances.

4. Require erosion control consideration in Environmental Impact Assessments.

Solano County, and all cities and agencies, should require that erosion, sedimentation, and erosion control evaluations be made for all projects requiring Environmental Impact Assessments.

Cost Considerations

There are three cost factors to consider in implementing these erosion control measures. First, there will be costs involved to the agencies who identify the critical areas, determine applicable controls, and draft erosion control ordinances. Second, there will be some increases in the cost of reviewing construction plans and inspecting the installation of control measures on site. Third, there are the costs of the erosion control measures themselves. Unit costs of many erosion control measures are provided in a Woodward-Clyde report to ABAG on control measures.

Control Land Use

Summary Description

Land use controls are institutional actions which affect the intensity of the use of land. These measures can be applied to surface runoff management problems directly by controlling the quantity of pollutants which enter surface waters or indirectly, by restricting the quantities of surface runoff thereby reducing the potential for pollutant runoff. Among the measures to be considered are: concentration of urban development to minimize the impervious land surface which will increase the quantity of runoff, control of certain types of land uses which are known to cause high amounts of pollutants or runoff in environmentally sensitive areas and subdivision design techniques which would reduce the peak amount of surface runoff.

Applicability and Effectiveness

Measures which maintain open space and those which control development patterns appear to be applicable to the study area. Both the Fairfield-Suisun and Collinsville-Montezuma Hills watersheds drain into Suisun Marsh where existing problems related to siltation and organic loadings have been noted and where potential problems resulting from urbanization are predicted. Controls on the intensity of uses adjacent to creeks would protect the marsh from increased siltation and water runoff caused by waterway modification and vegetation removal along and immediately adjacent to streams which flow into the marsh. Open space preservation will decrease the intensity of urbanization in the watershed thereby alleviating potential problems arising from toxic substances or septic tank failure.

Creekside controls can be expected to have a primary effect of improving water quality, however, measures to maintain open space will provide only a secondary, although important benefit to the improvement of surface runoff quality. Such measures may be more important for reducing hazards to life and property from fire and seismic activity. Enactment of these measures must be related to their total benefit to the community rather than as a solution to a single purpose problem such as water pollution.

Subdivision design review is a land use control which can be used to reduce the quantities of surface runoff. Natural drainage swales, temporary ponding or seepage basins and building design are techniques which can be used to alleviate runoff peaks. Reduction in street widths, and utilization of special drain designs and porous paving materials will reduce the amount of land covered by impermeable surfaces, thereby, reducing the amount of surface runoff. Although such techniques can reduce the cost of development, they have not been universally accepted in the past.

Present Practices

All communities within the study area have adopted Open Space and Conservation policies which more or less provide for the maintenance of open space. Most importantly the County of Solano, as the agency with land use jurisdiction over much of the non urbanized area, has designated considerable quantities of land for intensive and extensive agricultural use and for watershed preservation. In keeping with preservation policies, the county has recently raised the minimum extensive agricultural parcel size from 20 acres to 160 acres in much of the Collinsville-Montezuma Hills watershed. Actions are currently underway to apply recently adopted 160 acre watershed zoning provisions to the mountainous areas in the western portion of the Fairfield-Suisun Watershed. While this latter effort has been undertaken primarily to reduce hazards to life and property resulting from fire and construction upon unstable lands, it can also be expected to provide beneficial effects to surface runoff water quality. Finally, a recommendation contained in the County's recently adopted Health and Safety Element calls for adoption of creekside ordinances to protect streams from subsidence caused by seismic activity. To date this recommendation has not been implemented.

The Suisun Marsh Preservation Act of 1977 calls for several measures to protect the water quality of streams flowing into the Suisun Marsh. Among the measures which are relevant to the quality of surface water are adoption of buffer measures to streams, analysis of current agricultural practices for compatibility with marsh preservation, and controls on grading practices attendant to new construction. These measures also may be applicable to the Napa Marsh and to the Marshland within the Benicia State Recreational Area.

Recommended practices

1. Adopt creekside ordinances.

Solano County and its cities should implement creekside ordinances to protect riparian habitats and the marsh from increased siltation and water runoff caused by development adjacent to waterways flowing into the marsh.

2. Examine agricultural practices.

Solano County should examine minimum exclusive parcel sizes to determine the minimum size parcels necessary for long term agricultural productivity. The county should further examine agricultural practices on lands adjacent to Suisun Marsh to determine those uses which are compatible with the maintenance of marsh water quality. Measures should then be adopted to alter minimum agricultural parcel sizes as appropriate and to control those uses which are incompatible with the maintenance of marsh water quality.

3. Apply subdivision design review.

Application of subdivision design review should be further explored within the forum of the ongoing Technical Advisory Committee so that city and county staff members can use the experiences of other jurisdictions to determine how subdivision design techniques can be most effectively used.

4. Coordinate land use activities with Napa County.

Solano County should coordinate land use control measures with Napa County to insure watershed lands draining into the Suisun and Napa Marshes do not contribute to deterioration of surface water quality.

Cost Considerations.

The major cost items are administrative costs involved in the drafting of ordinances and the examination of agricultural practices.

TABLE 3

IMPACT ASSESSMENT SUMMARY

CONTROL MEASURE/ RECOMMENDED ACTION	ENVIRONMENTAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS	INSTITUTIONAL/ FINANCIAL IMPACTS
B. IMPROVE STREET CLEANING PRACTICES				
General Street Sweeping Impacts	AIR QUALITY ° small beneficial impact due to removal of dust from streets PHYSICAL RESOURCES ° collection of solid wastes that must be disposed of impacts disposal sites ENERGY ° use of gasoline for the operation of sweepers AMENITIES ° beneficial impact in visual appearance of streets ° temporary, localized noise disturbance due to street sweepers	PRODUCTION OF GOODS AND SERVICES ° street sweeping programs contribute to employment opportunities in public works	HEALTH AND SAFETY ° reduced risk of accidents as a result of debris removal PHYSICAL MOBILITY ° minor traffic disturbances by slow-moving sweepers	FISCAL ° cost of street sweeping must be offset by increased local revenues INSTITUTIONAL ° potential public objections to parking bans

TABLE 3 Continued

CONTROL MEASURE/ RECOMMENDED ACTION	ENVIRONMENTAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS	INSTITUTIONAL/ FINANCIAL IMPACTS
B. IMPROVE STREET CLEANING PRACTICES				
1. Conduct a street sweeping demonstration project	° same impacts as general street sweeping to greater degree in demonstration areas for short periods of time	<u>PRODUCTION OF GOODS AND SERVICES</u> ° potential opportunities for private consulting firms	° same impacts as general street sweeping to greater degree in demonstration areas for short periods of time	<u>FISCAL</u> ° small local effect-project qualifies for federal funding <u>INSTITUTIONAL</u> ° same impacts as general street sweeping to greater degree in demonstration areas for short periods of time
2. Prohibit flushing of materials from impervious surfaces	<u>AIR QUALITY</u> ° where flushing was practical, minor impact of increased fine dust <u>PHYSICAL RESOURCES</u> ° beneficial impact on water conservation <u>AMENITIES</u> ° potential loss of visual attractiveness of driveway and walks ° increase in noise if mechanical sweepers are used to replace flushing		<u>HEALTH AND SAFETY</u> ° elimination of risk of accidents on flushed surfaces while still wet <u>AMENITIES</u> ° inconvenience of having to sweep rather than flush	<u>FISCAL</u> ° potential source of revenue from penalties--expected to be minor <u>INSTITUTIONAL</u> ° public resistance to a flushing ban may occur if water again becomes plentiful
3. Establish guidelines for improving sweeping effectiveness	dependent on guidelines adopted--will increase or decrease general street sweeping impacts			

TABLE 3 Continued

CONTROL MEASURE/ RECOMMENDED ACTION	ENVIRONMENTAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS	INSTITUTIONAL/ FINANCIAL IMPACTS
C. CONTROL CHEMICALS				
1. Identify critical habitats and potential impacts of chemicals 2. Initiate a public education program aimed at home users of chemicals	<u>AIR QUALITY</u> ° proper application reduces amount of chemicals escaping into the air <u>PHYSICAL RESOURCES</u> ° proper application can prevent exposure of plants and animals to harmful substances ° crop yields highly dependent on fertilizers and pesticides	<u>PRODUCTION OF GOODS & SERVICES</u> ° some employment opportunities in County agencies may result	<u>HEALTH AND SAFETY</u> ° public education should help prevent accidents involving the use of chemicals	<u>FISCAL</u> ° program costs may necessitate tax increases--possibly on the sale of chemicals <u>INSTITUTIONAL</u> ° public opposition to chemical controls by some who might consider it a threat to agriculture
D. CONTROL DIRECT DISCHARGES				
1. Investigate an oil recycling program	<u>ENERGY</u> ° energy consumption to recycle oil offset by savings in crude oil processing	<u>PRODUCTION OF GOODS & SERVICES</u> ° a recycling center could create employment opportunities	<u>AMENITIES</u> ° inconvenience of delivering spent oil to a recycling center	<u>FISCAL</u> ° program costs would have to be offset by a tax increase--possibly on highway users
2. Initiate a public education program on the consequences of direct dumping		<u>PRODUCTION OF GOODS & SERVICES</u> ° administrative and advertising positions would be supported		<u>FISCAL</u> ° program costs would have to be offset by a tax increase

TABLE 3 Continued

CONTROL MEASURE/ RECOMMENDED ACTION	ENVIRONMENTAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS	INSTITUTIONAL/ FINANCIAL IMPACTS
E. IMPROVE SEPTIC TANK CONTROLS 1. Review and modify septic tank criteria 2. Monitor the septic tank inspection program		PRODUCTION OF GOODS AND SERVICES ° possible need for more inspectors INCOME AND INVESTMENT ° possible impact on required capital investments on new and replacement units	HOUSING SUPPLY ° effects on availability and costs of homes with septic tanks URBAN PATTERNS ° possible discouraging effect on rural home construction	FISCAL ° program costs could be offset by taxes on septic tank owners
F. CONTROL CATCHBASINS 1. Minimize Installation of new catchbasins 2. Monitor and maintain existing catchbasins 3. Implement catchbasin elimination programs	AIR QUALITY ° reduction in odor problems caused by some catchbasins ENERGY ° uncertain effects of energy required to clean catchbasins and pipes after implementation AMENITIES ° uncertain effects on noise created by vacuum cleaners	PRODUCTION OF GOODS AND SERVICES ° local increase in demand for precast inlets possible ° uncertain effects on manpower requirements of public works departments--probably minor	HEALTH AND SAFETY ° beneficial impact of reducing mosquitos and other health hazards of catchbasins	FISCAL ° some minor initial cost and later saving expected--uncertain net effect

TABLE 3 Continued

CONTROL MEASURE/ RECOMMENDED ACTION	ENVIRONMENTAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS	INSTITUTIONAL/ FINANCIAL IMPACTS
G. CONTROL EROSION				
1. Identify critical areas and applicable controls				
2. Implement erosion control program				
3. Establish erosion control ordinances				
4. Require erosion control considerations in environmental impact assessments				
IMPACTS OF EROSION CONTROL FOR CONSTRUCTION ACTIVITIES	<u>AIR QUALITY</u> ° reduction in wind-blown particles <u>ENERGY</u> ° some fuel-consuming machines may be involved <u>AMENITIES</u> ° improved visual appearance after construction	<u>CONSUMER EXPENDITURES</u> ° small effects on cost of new construction	<u>HOUSING SUPPLY</u> ° effects on location and timing of new housing starts <u>HEALTH AND SAFETY</u> ° safer construction site conditions should result <u>URBAN PATTERNS</u> ° possible reduction of development in erosion prone areas	<u>FISCAL</u> ° costs of increased review and inspection that could come from property tax base increase resulting from increased property values <u>INSTITUTIONAL</u> ° some public opposition could occur due to potential for increased home costs and property taxes

TABLE 3 Continued

CONTROL MEASURE/ RECOMMENDED ACTION	ENVIRONMENTAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS	INSTITUTIONAL/ FINANCIAL IMPACTS
IMPACTS OF EROSION CONTROL FOR AGRICULTURAL ACTIVITIES	AIR QUALITY ° reduction in wind-blown particles PHYSICAL RESOURCES ° beneficial impact from conservation of top soil and allowing otherwise unsuitable lands to be planted ENERGY ° some fuel-consuming machines are involved	PRODUCTION OF GOODS AND SERVICES ° beneficial impact of increased productivity ° opportunities on farms and with SCS are affected ° some measures would require capital investments by farmers ° uncertain effects on crop prices		FISCAL ° possible increases in property values and resulting tax receipts INSTITUTIONAL ° opposition by farmers due to initial costs

TABLE 3 Continued

CONTROL MEASURE/ RECOMMENDED ACTION	ENVIRONMENTAL IMPACTS	ECONOMIC IMPACTS	SOCIAL IMPACTS	INSTITUTIONAL/ FINANCIAL IMPACTS
H. CONTROL LAND USE 1. Adopt creekside ordinances 2. Examine agricultural practices 3. Apply subdivision design review 4. Coordinate land use activities with Napa County	PHYSICAL RESOURCES ° beneficial impacts to riparian and marsh habitats ° improvements in the quality of prime agricultural land ° improved recreational areas and potential AMENITIES ° maintain visual aesthetics of open and urban areas	PRODUCTION OF GOODS AND SERVICES ° some impacts on agricultural production might result	HOUSING SUPPLY ° potential for reduced availability of land for rural housing HEALTH AND SAFETY ° reduced hazards to life and property from fire, landslides, erosion, seismic activity, land subsidence, and floods EQUITY ° increases individuals' available choice for employment and recreational opportunities URBAN PATTERNS ° impacts on the location and density of future urban development	INSTITUTIONAL ° possible opposition by agricultural interests, business groups, and private citizens

B. CONTINUING PLANNING PROGRAM

Need For Continuing Planning

A continuing Surface Runoff Management Planning Program for Solano County would provide a way to further develop and refine appropriate surface runoff management techniques for the County. Due to the lack of data and the present state-of-the-art in non-point source pollution control, the Surface Runoff Management Plan recommended for Solano County is by necessity a cautious one.

There is some evidence that water quality problems in Solano County are aggravated by surface runoff, but they are not well quantified. The techniques for controlling surface runoff are sometimes costly and their effectiveness is not well documented. Consequently, the recommended Surface Runoff Management Plan stresses the continuation of existing programs with some modifications, and those measures which obviously are needed for surface runoff management.

The objectives of the continuing planning program are summarized below:

- ° to maintain a central location for administering the recommended plan which will be carried out by several agencies throughout the County.
- ° to develop additional data and information to use as a basis for deciding whether to pursue certain control measures more vigorously or to modify or delete others.
- ° to provide a central location for the review of results and findings of other Surface Runoff Management agencies and the EPA and to determine their applicability to Solano County.
- ° to report accomplishments and to prepare periodically an updated Surface Runoff Management Plan.

Recommended Program

In order to accomplish the objectives set forth in the preceding section, the initial program is outlined briefly in the following paragraphs.

1. Staff a Surface Runoff Section.

A section to coordinate surface runoff management planning would be established within the County Department of Public Works. To provide an adequate continuing planning process in the initial years, a half-time position should be provided for this purpose, with a quarter to a half-time support from the County Planning Department.

2. Continue the Surface Runoff Management Technical Advisory Committee.

The Technical Advisory Committee (TAC) would be continued to assist the Surface Runoff Section and to provide information and perform specific studies as required. Solano County cities not in the ABAG 208 study area should be invited to participate in the TAC in order to benefit from the efforts of the Committee.

3. Retain the Surface Runoff Management Citizens Advisory Committee. (ad hoc)

The Citizens Advisory Committee should be retained on an ad hoc basis as needed to provide information and feedback on implemented and proposed control measures.

4. Implement a continuing water quality monitoring program.

A surface runoff monitoring program should be developed by the Surface Runoff Section to acquire the type of data that was sought in the ABAG sampling program. This program would serve two primary purposes. First, it would provide additional data that would help to characterize the wasteloads unique to Solano County. Secondly, if it is continued into the future, the data will assist in assessing the effectiveness of the Surface Runoff Management Plan. At least two sampling locations should be considered. The Green Valley location representing a rural area used in the ABAG study is a good choice, and a second location would be in an urbanized area such as Fairfield. The proposed program is further described in Appendix B.

5. Implement a continuing public education program.

A continuing public education program should be implemented by the Surface Runoff Section to keep the public aware of the activities of the various participating agencies and how they can play an active role in surface runoff control.

6. Review findings of other Surface Runoff Management agencies and the EPA.

The Surface Runoff Section would determine the applicability of findings of other Surface Runoff Management agencies to Solano County.

7. Prepare periodic reports.

The county would be required to prepare surface runoff management reports presenting the status of the program, data collected, interpretation of the new data, other relevant findings, and program updates.

C. SCHEDULING AND COST ESTIMATES

This section draws together information on scheduling of plan implementation activities, agency assignments and projected costs. Implementation activities (Table 4) are scheduled for a six year period, with most special planning and regulatory enactment activities occurring in the first two fiscal years.

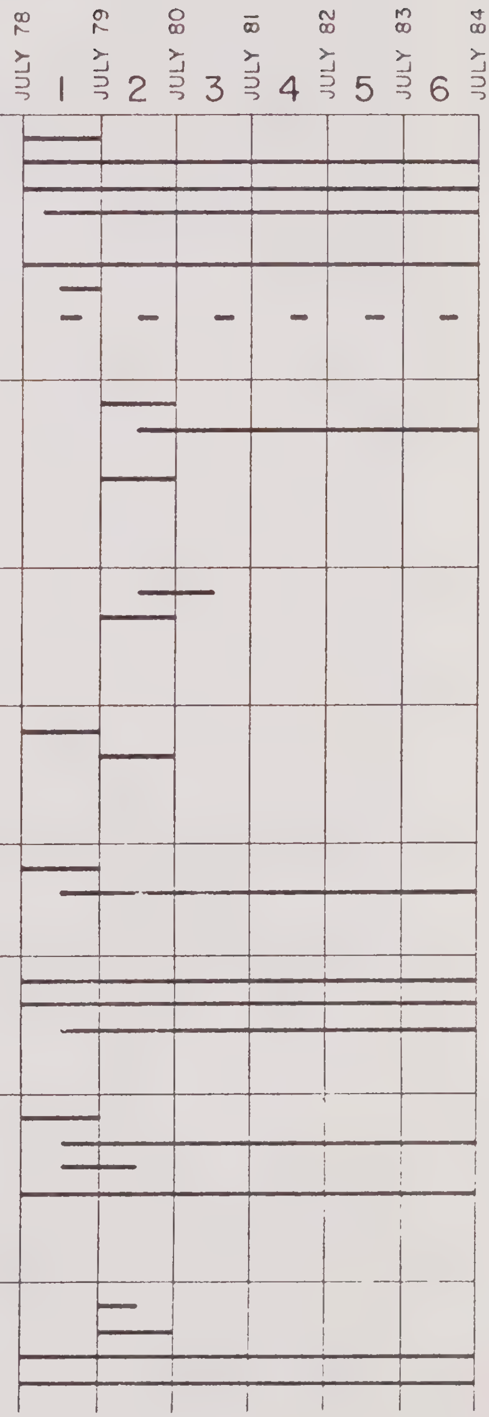
Primary responsibility for plan implementation will be assigned to the Surface Runoff Section, comprised of representatives of the County's Public Works and Planning Departments. Cities are asked to work toward improved street cleaning practices and a catchbasin control program, as well as to participate in public educational and Technical Advisory Committee activities and to adopt various regulatory ordinances. The County Health Department will continue its current septic tank monitoring program and the Agricultural Commissioner's Office will continue its existing pesticide control program.

Program costs are approximately $40,000 for the first year and $65,000 for the second year. Costs decline in years three through six after major planning, the street sweeping demonstration and regulatory enactment efforts are concluded. Funding sources are expected to be the county and cities general funds used to support current staffing requirements. Outside funding sources will be sought to support a number of the proposed activities, including: water quality monitoring, street sweeping demonstration program, identification of critical erosion areas and land use regulations. Cost estimates for the program are shown in Table 5.

Cost estimates have been derived from calculating task hours required to complete a given activity and then multiplying those hours times salaries and benefits plus fixed overhead costs. The major impact of the program will be felt by the County Public Works Department which will be required to devote the staff time of an additional half person to administer the Surface Runoff Management Plan. Less effort will be required on the part of other agencies and the cities. The County Planning Department will be required to devote an additional one quarter staff members' time; however, it is anticipated that no additional staffing will be required to carry out surface runoff management activities.

D. SIX YEAR IMPLEMENTATION SCHEDULE

TABLE 4



SURFACE RUNOFF MANAGEMENT PLAN

A. General Administration and Continuing Planning Program

1. Staff a Surface Runoff Section
2. Continue the SRM Technical Advisory Committee
3. Retain the SRM Citizens Advisory Committee (ad hoc.)
4. Implement a continuing water quality monitoring program.
5. Initiate a continuing public education program.
6. Review findings of other SRM agencies and the EPA.
7. Prepare periodic reports

B. Improve Street Cleaning Practices

1. Conduct a street sweeping demonstration project.
2. Prohibit flushing of materials from impervious surfaces.
3. Establish guidelines for improving street sweeping effectiveness.

C. Control Chemicals

1. Identify critical habitats and potential impacts.
2. Initiate a public education program aimed at home users of chemicals.

D. Control Direct Discharges

1. Investigate an oil recycling program.
2. Initiate a public education program on the consequences of direct dumping.

E. Improve Septic Tank Controls

1. Review and modify septic tank criteria.
2. Monitor the septic tank inspection program.

F. Control Catchbasins

1. Minimize installation of new catchbasins.
2. Monitor and maintain existing catchbasins.
3. Implement catchbasin elimination programs.

G. Control Erosion

1. Identify critical areas and applicable controls.
2. Implement erosion control program.
3. Establish erosion control ordinances.
4. Require erosion control considerations in Environmental Impact Assessments.

H. Control Land Use

1. Adopt creekside ordinances.
2. Examine agricultural practices.
3. Apply subdivision design review.
4. Coordinate land use activities with Napa County.

TABLE 5

SURFACE RUNOFF MANAGEMENT PLAN COST ESTIMATE (1977 $) AND ASSIGNMENT OF ACTIVITIES

	YEAR 1 78-79	2 79-80	3 80-81	4 81-82	5 82-83	6 83-84	Task Assignment
A. General Administration and Continuing Planning Program							
1. Staff a Surface Runoff section.	$880						Planning/Public Works
2. Continue the SRM Technical Advisory Committee (TAC)	$7040	$7040	$7040	$7040	$7040	$7040	Surface Runoff Section & TAC
3. Retain the SRM Citizens Advisory Committee (ad hoc.)	880	880	880	880	880	880	Surface Runoff Section & CAC
4. Implement a continuing water quality monitoring program.	7760	7760					Surface Runoff Section
5. Initiate a continuing public education program.	2760	1380	2760	2760	2760	2760	Surface Runoff Section
6. Review findings of other SRM agencies and the EPA.	1760	1760					Surface Runoff Section
7. Prepare periodic reports.	1760	1760	1760	1760	1760	1760	Surface Runoff Section
B. Improve Street Cleaning Practices							
1. Conduct a street sweeping demonstration project.		20,000					Fairfield & Surface Runoff Section
2. Prohibit flushing of materials from impervious surfaces.		1848	1848	1848	1848	1848	Cities
3. Establish guidelines for improving street sweeping effectiveness.		880					Surface Runoff Section & Cities
C. Control Chemicals							
1. Identify critical habitats and potential impacts.		880	880				Ag. Commissioner & Surface Runoff Section
2. Initiate a public education program aimed at home users of chemicals.		880					Ag. Commissioner & Surface Runoff Section
D. Control Direct Discharges							
1. Investigate an oil recycling program.	1760						Surface Runoff Section
2. Initiate a public education program on the consequences of direct dumping.		2760					Surface Runoff Section
E. Improve Septic Tank Controls							
1. Review and modify septic tank criteria	528						Health Department
2. Monitor the septic tank inspection program.	528	1056	1056	1056	1056	1056	Health Department & Surface Runoff Section
F. Control Catchbasins							
1. Minimize installation of new catchbasins.							Cities & County
2. Monitor and maintain existing catchbasins.	4880	4880	4880	4880	4880	4880	Cities, County & Special Districts
3. Implement catchbasin elimination programs.	1320	2640	2640				Cities & County
G. Control Erosion							
1. Identify critical areas and applicable controls.	4400						SCS, TAC & Surface Runoff Section
2. Implement erosion control program	440	440	220	220	220	220	SCS & County PW
3. Establish erosion control ordinances.	2640	660					County & Cities
4. Require erosion control considerations in Environmental Impact Assessments.							County & Cities
H. Control Land Use							
1. Adopt creekside ordinances.		2860					Cities & Planning Department
2. Examine agricultural practices.		2200					Planning Department
3. Apply subdivision design review							TAC & Surface Runoff Section
4. Coordinate land use activities with Napa County	220	220	220	220	220	220	Planning Department & Surface Runoff Section
TOTAL	$39556	$62784	$24184	$20664	$20664	$20664	

The Solano County Surface Runoff Management Plan was prepared jointly by the Solano County Planning and Public Works Departments with the assistance of Water Resources Engineers, Inc. and James M. Montgomery, Consulting Engineers, Inc.

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Appendices

Solano County Surface Runoff Water Quality Management Plan

Prepared by Solano County, October 1977

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES, CON'T.

LIST OF TABLES

Appendix A
Surveys & Research

PAST STUDIES

The following Table A-1 is a listing of past studies related to surface runoff in Solano County. These reports were reviewed for information relevant to the surface runoff plan.

SURVEY OF LOCAL AGENCIES

The Technical Advisory Committee (TAC) was formed to assist in the preparation of the plan. It consists of representatives from various city, county, and federal agencies in the study area concerned with surface runoff. Meetings of the TAC, among other things, were used to identify and discuss actual and potential water quality problems in the study area that may be related to surface runoff. In addition, written comments were received in the form of replies to a problem identification questionnaire. This questionnaire included responses to problems on the land, problems in the water, and problems in the stormwater system, as related to each TAC members jurisdiction.

A general biological field survey of Green Valley Creek was conducted by ABAG in January of 1977 in which high organic loading and siltation were observed.

HYDROLOGIC AND WATER QUALITY DATA

To provide data to be used in the preparation of the surface runoff plan and for the continuing planning process, the hydrologic and water quality data base for the study area was assembled. Table A-2 lists the precipitation, evaporation, and streamflow gaging stations which are located on the map labeled Figure A-1. Table A-3 identifies the water quality sampling sites found on the map, Figure A-2.

TABLE A-1

INVENTORY OF SURFACE RUNOFF STUDIES

Author	Title	Date	Purpose of Study	Subjects Investigated	Major Findings	Comments, Significance of Study to Surf. Runoff Plan
Hyde, Charles Gilman & Brown & Caldwell	The Collection, Treatment, and Disposal of the Sewage and Storm Drainage of the City of Rio Vista, Calif.	July 1952	Storm & sanitary sewerage planning for Rio Vista	Sewerage & Drainage Needs; Alternative Plans	Plans to be implemented	15-yr. frequency storms used for design -- apparently by Rational Method
Brown & Caldwell	Vallejo Sewerage & Drainage Survey	August 1953	Storm & sanitary sewerage planning for Vallejo	Sewerage & Drainage Needs; Alternative Plans	Plans to be implemented	Detailed descriptions of Vallejo watershed (about 30)--Note: Development is 1953 level, however.
Stoddard & Karrer-Fresno	Solano County Water Resources & Requirements	December 1959	Assess present & future water supplies & needs in Solano County	Supplies, Requirements for Water; Effects of Salinity Intrusion into the Delta; Ag. Drainage	Average Annual Runoff by Drainage Units, Population & Land Use Projections	Useful hydrologic information Limited quality data
Thomsson H.G., F.H. Olhsted, & E.F. LeRoux; USGS	Geology, Water Reservoirs & Usable Ground-Water Storage Capacity of Part of Solano County, Calif., Water Supply Paper 1464	1960	1) To determine the storage capacity of GW basins underlying the poposed Solano Project, 2) To determine the usable storage capacity, & 3) To determine feasibility of GW recharge	Basic data collection; summary of surface water features; extensive study of ground water resources	600,000 a.f. usable GW storage in Putah area; much less usable capacity in Suisun-FF area..Some scattered quality records for streams	Data for stream quality is sketchy, from 1946-51. Might be somewhat indicative of predevelopment (but agricultural) conditions
Ulatis Soil Conservation District, Solano Irrigation District, & SCFCWCD	Watershed Work Plan Ulatis Creek Watershed + Supplement (Boyle Engr) + 2 Hydrologic Design Booklets (US-SCS) +Misc. Studies	1961 1967 1962-64 1960	Background and Hydrologic-Hydraulic Analyses	Watershed Problems, Improvements Needed, Hydrologic Analyses, Hydraulic Designs, Benefit-Cost Study	Levees, Channel improvements, pumping facilities required	Lots of flood frequency analyses in the attachments
U.S. Army Engineer, District-Sacramento	Green Valley Creek Solano County, Calif.	April 1960	Report on hydrology & economics of proposed creek improvements	Dan Wilson & Green Valley Creeks, Hydrology, Flood Analyses, Benefits & Costs	Project of channelization should go forward	No quality data. Not significant to surface runoff study

TABLE A-1 - CONTINUED

Author	Title	Date	Purpose of Study	Subjects Investigated	Major Findings	Comments, Significance of Study to Surf.Runoff Plan
Brown & Caldwell	City of Fairfield - The Collection & Disposal of Storm Water	August 1961	Determine long-range program of drainage improvements in Fairfield	Environmental Characteristics, Existing Storm Drainage, Basis of Project Development, Proposed Improvements	Stage I channel & holding basin in Laurel Crk. Watershed be constructed	Done for "ultimate" development. 50 yr. storm for major works. 5 yr. storm for minor works.
Dept. of Fish & Game, Dept. of Water Resources	Delta Fish & Wildlife Protection Study, Annual Report (1961-62)	June 1962	Investigate effects of Delta Project Alternatives on Fish & Wildlife	Changes in the environment, Projected effects on Fish, Projected effects on Wildlife	Master Work Plan for further study	Not relevant to surface runoff plan.
Yoder, M. Carleton	City of Vacaville - A Survey of Storm Drainage	June 1962	Investigate storm drainage needs of City of Vacaville	"General Considerations" Review of Drainage Problems, Storm Drainage Designs, Proposed Facilities	A storm drainage plan	Used "Unsley Method" which accounts for detention storage. No quality information.
Dept. of Water Resources	Delta Water Requirements Appendix to Bulletin No. 76 Delta Water Facilities (Preliminary Edition)	Feb. 1962	Present comparison of alternative solutions to Delta problems	Economic growth, Delta water requirements, water supplies of the Delta	Effective percipitation Irrigation Efficiencies	Contains (old) population and land use projections for the Delta region. Crop requirements.
U.S. Army Corps of Engineers - Sacramento	Operation & Maintenance Manual for Green Valley Creek-Solano County, CA.	Aug. 1963	To transmit & explain Army regulations to local agencies	Local cooperation requirements, Maint. & Op. Procedures, Project features	None - Information transmitted	Contains profiles of Green Valley & Dan Wilson Creeks
Interagency Delta Committee	Plan of Development Sacramento-San Joaquin Delta	Sept. 1964	To review comprehensive Delta W ater Plans	The Hydraulic Barrier Plan, The Physical Barrier, The Delta Waterway Contract Concept, The Peripheal Canal	Recommended Peripheral Canal	Not helpful

TABLE A-1 - CONTINUED

Author	Title	Date	Purpose of Study	Subjects Investigated	Major Findings	Comments, Significance of Study to Surf. Runoff Plan
Kaiser Engineers	Engineering Study of Increased Water Supply Facilities for the City of Vallejo	Sept. 1964	Reinvestigate Vallejo's capability to provide additional water supply	Demands on Vallejo system from Benicia & Napa Co. Pumping alternatives to increase supply. North Bay Aqueduct	Improvements in pumping capacity can be made	Not helpful
Brown & Caldwell	Predesign Study-Sewerage & Drainage Improvements Vallejo Sanitation & Flood Control District	Dec. 1965	To outline necessary sewerage & storm drainage improvements in Vallejo	Design criteria, existing facilities, proposed projects,-storm drainage, sewers, treatment plant, sewer separation	Specific recommendations on storm drainage, sewerage & plant improvement 5 yr.Or 15 yr.storms used for design	Runoff coefficients = 0.20 -0.80 Rational Method used No quality information
M.C. Yoder Associates	A Survey of Storm Drainage Southeast of Interstate Highway 80, Vacaville	Dec. 1965	Development of Long Range Drainage Plan for City of Vacaville & surround-area	Area, topography, soil, climate, land use, basis of design, recommended improvements	$5,200,000 construction program recommended. 10-yr storm used for design	Runoff coefficients = 0.25 - 0.90 Rational Method used No quality.
Simpson, Stratta & Associates Karl H. Baruth	Suisun Soil Conservation District-Final Report Phase I	Aug. 1966	General evaluation of resources, uses, values in the Suisun Marsh area	Land use, wildlife, water supply & water rights, recreational economics	Pre-Bay-Delta Study conclusions on effects of Sacramento River operation on the Marsh	Contains General Soil Map. Land Use Map, Vegetation Map for this particular area
U.S. Army Corps of Engineers - Sacramento	Review Report for Flood Control on Streams in the Vicinity of Fairfield,CA.	Oct. 1967	To document flood potential & proposed solutions for Fairfield area	Economic development, Hydrology, Flood damages, Control Plans, Costs, Benefits, The Project	All related to the Project - Not to runoff	No runoff records available. No quality information. Does give design tidal conditions.

TABLE A-1 - CONTINUED

Author	Title	Date	Purpose of Study	Subjects Investigated	Major Findings	Comments, Significance of Study to Surf. Runoff Plan
Karl Baruth Associates	Suisun Soil Conservation District-Master Plan Report Phase 2	May 1968	Inventory of Water Areas, Future Land/Water Uses	Fresh Water Sources & Needs Agricultural-Hunting-Other Land Uses	Not Relevant.	Of no value
San Francisco Bay Conservation & Development Commission	Preliminary San Francisco Bay Plan	1969	Develop Plan for Conservation of San Francisco Bay	Conservation ideas Development ideas	A regional agency is needed	Not significant
Board of Consultants	San Francisco Bay-Delta Water Quality Control Program	June 1969	50-yr. Pollution control plan for the Delta & Bay	Varied technical, policy & institutional problems of regional point source pollution control	Numerous, but not relevant	Not significant
Brown & Caldwell	Chabot Creek Drainage Study	June 1971	Drainage Improvements for Chabot Creek Drainage Basin-Vallejo	Subarea runoff quantities - channels to contain flows	Flood profiles, channels to contain flows	Runoff coefficients for Vallejo subareas
U.S.Army Corps of Engineers-Sacramento	Flood Plain Information Green Valley, Dan Wilson, & Suisun Creeks - Cordelia California	June 1972	Description of flooding potential of Green Valley, Dan Wilson & nearby creeks	Flood, Situation, Past Floods, Future Floods	Flooded areas, Flood profiles	Gives SPF, Regional Floods, Frequencies of other floods-all channel related. No quality.
U.S. Bureau of Reclamation	An Appraisal of Total Water Management in the Central Valley Basin, CA.	Aug. 1972	Overall look at & reappraisal of water management in Central Valley Project Area	Present development, constraints on further development, Alternatives for study, Schedule for further study	The CVP must be continually reevaluated & modified	Watershed management is a small option to be considered in future Bureau study

TABLE A-1 - CONTINUED

Author	Title	Date	Purpose of Study	Subjects Investigated	Major Findings	Comments, Significance of Study to Surf. Runoff Plan
Pesonen, E.A. (Alex)	Plan for a Putah Creek Streamway	Jan. 1973	Recreational values of a developed Putah Creek	Natural values of the stream, developed values of the stream	Much of the stream is still in a wild condition, but it needs water(!)	Little or no relevance
Limerinos, J.T. K.W. Lee & P.E. Lugo	Flood Prone Areas in the San Francisco Bay Region, California	1973	Provide maps of flood prone areas	Flooding levels-100-yr frequency	As noted	General value related to flood prone areas
Wilsey & Ham	Master Storm Drainage Study-Cordelia Area	May 1974	Master Plan for Drainage Works near Cordelia	Channel improvements, watershed treatment, natural channels	Watershed magement must be used in addition to channel maintenace	HEC-1 used to size channel. Hourly rainfall at Fairfield. 100-yr flows used.
Dept. of Water Resources	California's Ground Water	Sept. 1975	General overview of State's ground waters	Locations, extent, problems of California aquifers	Results presented	Little or no value
U.S. Army Corps of Engineers-	Fairfield Vicinity Streams General Design Memorandum Phase 1	Oct. 1975	Description of needs for Creek channelization project	Needs, Investigations, Selected Plan, Alternatives, Effects, Public Participation	Project is needed	See pp. 60-61. Urban nonpoint source pollutant loads may be increased
U.S. Army Corps of Engineers-Sacramento	Fairfield Vicinity Streams Final Environmental Statement	Oct. 1975	Environmental Review of Creek Channelization Project near Fairfield, CA.	All required by EPA - Project description, alternatives, impacts	Recommended Project Description Recommended Project Environmentally Superior	Some deterioration in runoff quality will result
San Francisco Bay Conservation & Development Commission	Preliminary-Suisun Marsh Protection Plan	Oct. 1976	To have a plan for protection of wildlife in Suisun Marsh	Resources inventories (general), Plans & policies for future marsh protection	The marsh is invaluable & must be preserved	Some general information on erodibility of soils in limited locations near Suisun Marsh.

TABLE A-2
GAGING STATIONS
PRECIPITATION STATIONS

Map Number	Station	Station Number	Source of Data	Elevation	Period of Record
1	Markley Cove	5360	USWB	480'	1969-Present
2	Lake Solano	4712	USWB	140'	1974-Present
3	Vacaville	A00-9200-07		68'	1948-1953
4	Elmira Sprr	A00-2772	State Climatologist	72'	1891-1918
5	Vacaville Sprr	A00-9200-05	State Climatologist	164'	1891-1918
6	Vacaville	A00-9200	USWB	104'	1880-Present
7	Fairfield 3NNE	E30-2935	USWB	110'	1972-Present
8	Lake Curry	4677	Vallejo Water Dept.	396'	1926-Present
9	Lake Frey	E30-4684	Vallejo Water Dept.	400'	1915-Present
10	Wildhorse Valley	E30-9675-41	Vallejo Water Dept.	1240'	
11	Lake Madigan	None	WRE/JMM	1400'	1976-Present
12	Napa St. Hosp.	6074	USWB	60'	1878-Present
13	Sonoma	E20-8351-06	Sonoma County	20'	1957-Present
14	Sonoma	E20-8351-07	Sonoma County	100'	1950-Present
15	Sleepy Hollow	E20-8286	Sonoma County	50'	1929-Present
16	Buchli Is.	152-51	Cal. Water & Tel. Co.	3'	1952-1960
17	Dutton Landing	2580	USWB	20'	1955-Present
18	Napa Co. Airport	6071	USWB	20'	
19	Willota Ranch	E30-9687-02		375'	1914-1917
20	Willota Ranch	E30-9687-03		50'	1899-Present
21	Fairfield	E30-2936	USWB	50'	
22	Fairfield Fire Sta.	E30-2934	USWB	34'	1951-Present
23	Fairfield	E30-2933	USWB	13'	1940-1972
24	Suisun Sprr	E30-8628-01		20'	1871-Present
25	Potrero Hill	E30-7103-01	State Climatologist	31'	1941-1942
26	Potrero Hills	E30-7103	USWB	130'	
27	Denverton Is.	E30-2399-48		22'	1950-Present
28	Rio Vista	B90-7446-03		15'	1933-1953
29	Rio Vista	A00-7446-02		63'	1949-Present
30	Rio Vista	A00-7446-01		85'	1956-Present
31	Rio Vista	B90-7446	USWB	40'	1959-Present
32	Rio Vista	A00-7446-04			
33	Hamilton Ranch	A00-3729-48		150'	1961-Present
34	Shilo	E30-8172-48		40'	1932-1951
35	Birds Landing	E30-0814-48			1958-Present
36	Grizzly Island	B90-3650	USWB	1'	1970-Present
37	Sears Point	E30-8065-01	State Climatologist	10'	1953-1955
38	Joice Island	E30-4332	USWB	10'	1955-1959
39	Fleming Hill	E30-3094	Vallejo Water Dept.	260'	
40	So. Vallejo	E30-842-01	State Climatologist	23'	1892-1918
41	Tara Hills T.P.	E40-8784-50	Contra Costa County	20'	1969-Present
42	Benicia Pump Plant	E30-0669		20'	1911-1932
43	Lake Herman	E30-4685		100'	1921-1932
44	Martinez Harbor View	E40-5371-40		105'	1965-Present
45	Martinez Fire Sta.	E40-5377	USWB	26'	1891-Present
46	Martinez Water Plant	E40-5371-40	Contra Costa County	40'	1961-Present
47	County Gar. Sheil Ave.	E40-2073-51	Contra Costa County	95'	1951-Present
48	Saranap	E40-7991	Contra Costa County	350'	1953-Present
49	Chenery Filter Plt.	E40-1695	Cal. Weather Service Co.	13'	1931-Present
50	Port Chicago N.D.	E40-7070	USWB	50'	1946-1975
51	Shore Acres T.P.	E40-818-50	Contra Costa County	7'	1965-Present
52	Pittsburg Dow Chem.	B80-6949		14'	1947-Present
53	Collinsville	E30-1919		10'	1947-Present
54	Collinsville	A00-1919-02		20'	1958-Present

TABLE A-2 - Continued

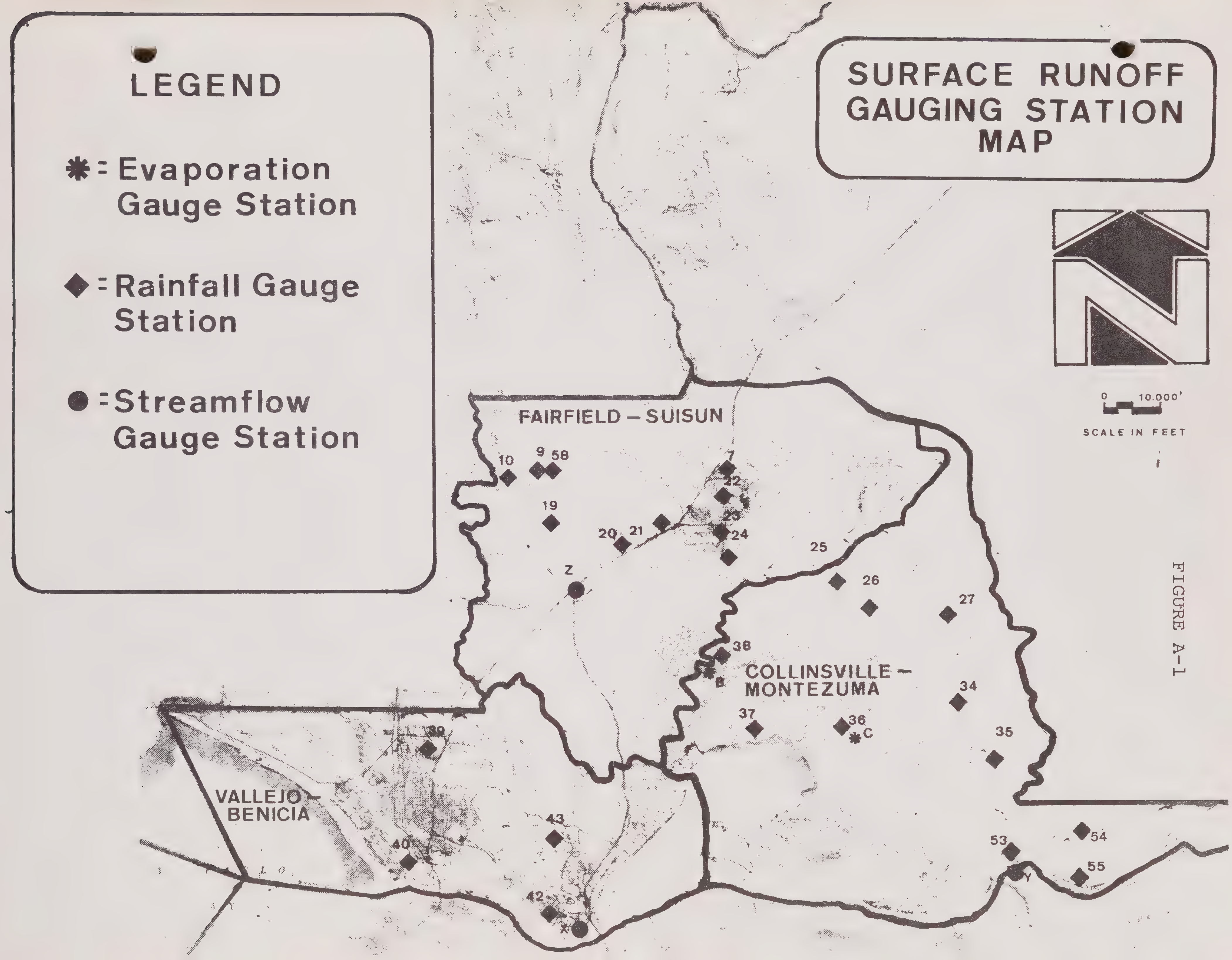
Map Number	Station	Station Number	Source of Data	Elevation	Period of Record
55	Montezuma Hills	A00-5805		20'	1923-1967
56	Antioch Fibrebd. Mill	B90-0227	USWB	28'	1879-Present
57	Crockett	E40-2177	USWB	12'	1918-Present
58	Green Valley	E30-3612-01	Vallejo Water Dept.	414'	1893-Present

EVAPORATION STATIONS

Map Letter	Station	Pan Type	Source of Data	Elevation	Period of Record
A	Dutton Landing	Class A	USWB	20'	1955-Present
B	Joice Island	Class A	USWB	10'	1955-1959
C	Grizzly Island	Class A	USWB	1'	1970-Present
D	Martinez Filt. Plant	Class A	USBR	55'	1950-1963

STREAMFLOW GAGING AND PEAK DISCHARGE STATIONS

Map Letter	Station	Source of Data	Type of Data	Period of Record
X	Suisun Bay at Benicia	DWR #EO 3300	Peak Discharge	1929-Present
Y	Sacramento River at Collinsville	DWR #B 91110	Peak Discharge	1929-Present
Z	Green Valley near I80	USBR #X 00044	Recording	-Present



LEGEND
✱ = Evaporation Gauge Station
◆ = Rainfall Gauge Station
● = Streamflow Gauge Station
SURFACE RUNOFF GAUGING STATION MAP
0 10,000'
SCALE IN FEET
FAIRFIELD – SUISUN
COLLINSVILLE – MONTEZUMA
VALLEJO – BENICIA
10
9
58
7
22
19
23
24
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21
25
26
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Z
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B
34
37
36
C
35
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40
53
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55
Y
42
X

FIGURE A-1

TABLE A-3
WATER QUALITY SAMPLING SITES

Map Number	Location	Source of Data	Type of Data*	Monitoring Period
1	Laurel Creek at SNRR	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
2	McCoy Creek South of SPRR	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
3	Union Ave. Creek in Fairfield	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
4	Ledgewood Creek Near 180	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
5	Laurel Creek at Route 12	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
6	McCoy Creek South of SPRR	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
7	Hill Slough at Grizzly Is.	USBR #54	Extensive	1965-1974
8	Hill Slough Near Suisun Slough	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
9	Ledgewood Creek near SPRR	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
10	Alonzo Drain at Cordelia Rd.	USGS #580	Limited (periodic)	1970-Present
11	Ledgewood Creek near Peytonia Slough	Corps of Engineers, Sacr. Dist.	Extensive	1974-1975
12	Raines Drain at Chadbourne Rd.	USGS #600	Limited (periodic)	1970-Present
13	Green Valley Creek at Cordelia Rd.	USBR #514	Extensive (periodic, wet)	1967-1974
14	Cordelia Slough Upper End by SPRR	USBR #561	Extensive	1974-Present
15	Cordelia Slough Upper End	USBR #561	Extensive	1967-Present
16	Chadbourne Slough at Chadbourne Rd.	USBR #522	Extensive (monthly)	1965-1974
17	Suisun Slough at Joke Is.	USBR #542	Extensive (monthly)	1965-Present
18	Suisun Slough at Teal	DWR #EOS 810.2, 204.1	Stnd. Minerals	9/24/68
19	Cordelia Slough at Cygnus	USBR #533	Extensive (monthly)	1963-1974
20	Suisun Slough Near Cygnus	DWR #EOS 809.2, 204.2	Stnd. Minerals	9/24/68
21	Suisun Slough Below Goodyear Slough	DWR #EOS 808.0, 204.8	Stnd. Minerals	9/24/68
22	Suisun Slough near Benicia	DWR #EOS 807.2, 203.7	Stnd. Minerals	9/24/68
23	Suisun Bay at Grizzly Is.		Extensive (monthly)	1968-Present
24	Montezuma Slough near Mouth	DWR #EOS 808.4, 203.6	Stnd. Minerals	9/24/68
25	Montezuma Slough above Hunter Cut	DWR #EOS 810.0, 202.5	Stnd. Minerals	9/24/68
26	Montezuma Slough below Tree Slough	DWR #EOS 810.6, 200.6	Stnd. Minerals	9/24/68
27	Montezuma Slough near Beldon Landing	DWR #EOS 811.2, 158.2	Stnd. Minerals	7/8/68-5/14/70
28	Montezuma Slough at Grizzly Is. Rd.	USBR	Extensive (monthly)	1963-1974
29	Montezuma Slough	DWR #EOS 810.3, 157.4	Stnd. Minerals	9/23/68
30	Montezuma Slough at Lingos Landing	DWR #EOS 809.5, 155.6	Stnd. Minerals	9/24/68
31	Montezuma Slough at Meins Landing	DWR #EOS 808.4, 154.5	Stnd. Minerals	9/24/68
32	Montezuma Slough near Molena	DWR #EOS 807.6, 513.8	Stnd. Minerals	9/24/68

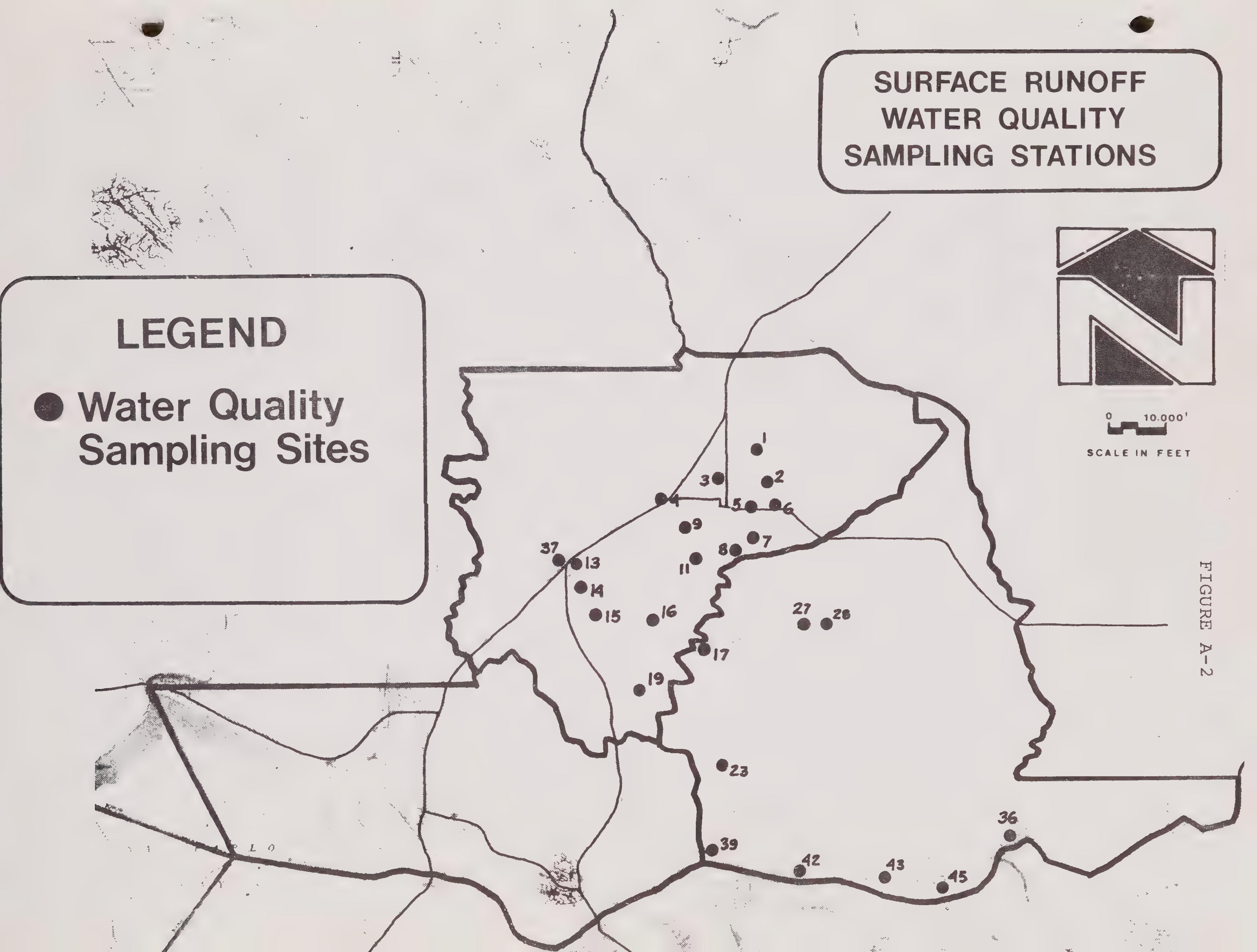
TABLE A-3 - Continued

Map Number	Location	Source of Data	Type of Data*	Monitoring Period
33	Montezuma Slough below Grizzly Slough	DWR #EOS 806.3, 153	Stnd. Minerals	9/24/68
34	Montezuma Slough near Montezuma Station	DWR #EOS 505.3, 512.9	Stnd. Minerals	9/24/68
35	Montezuma Slough at Sac. River	DWR #EOS 804.3, 151.8	Stnd. Minerals	9/24/68
36	Sacramento River at Collinsville	USBR #C-2	Limited (Quarterly)	1950-Present
37	Green Valley Creek near I80	WRE/JMM	Extensive (wet)	1976-Present
38	Suisun Bay Cutoff at Pt. Buckler	DWR #EOB 805.7, 201.2	Stnd. Minerals	9/24/68
39	Suisun Bay near Preston Pt.	USBR #D2	Extensive (monthly)	1968-Present
40	Suisun Bay at Benicia	DWR #EOB 802.5, 208.1	Stnd. Minerals	3/69-6/71
41	Suisun Bay at Freeman Is.	DWR #EOB 804.6, 159.5	Stnd. Minerals	9/24/68
42	Suisun Bay at Middle Pt.	USBR #D8	Extensive (monthly)	1968-Present
43	Suisun Bay at Honker Bay	USBR #D9	Extensive (monthly)	1968-Present
44	Sacramento River near Simmons Pt.	DWR #EOB 803.0, 155.9	Stnd. Minerals	9/24/68
45	Sacramento River at Chipps Is.	USBR #D-10	Extensive (monthly)	1968-Present
46	Suisun Bay near Benicia	USBR #EOB 802.6, 207.1	Stnd. Minerals	

*EXTENSIVE: Includes nearly all types of physical, chemical, and biological data, except sediment. Exact constituents sampled vary by location.

LIMITED: Includes several specific constituents, but not as complete a set of data as in EXTENSIVE.

STANDARD MINERALS: Specific conductance, pH, total dissolved solids, percent sodium, hardness, turbidity, temperature, dissolved oxygen, calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, nitrate, fluoride, boron, silica, phosphate, and seven heavy metals.



SURFACE RUNOFF
WATER QUALITY
SAMPLING STATIONS
LEGEND
Water Quality Sampling Sites
0 10,000'
SCALE IN FEET
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FIGURE A-2

Appendix B
Water Quality Sampling Program

PROGRAM DESCRIPTION

The following is a description of the sampling program as written prior to the start of the sampling.

Introduction

The purpose of the sampling program is to obtain information on the relationship between land use and storm runoff water quality. Data from the sampling program will be used to estimate pollutant mass emission rates from watersheds with varying types of land use. This information will be used for verification of the storm water runoff model which will be used by ABAG and the counties as part of the 208 program.

Site-Selection

The Green Valley Drainage Basin was selected as the demonstration watershed for Solano County. The basin has an area of approximately 15 square miles and is primarily rural. The Green Valley Basin is shown on Figure B-1.

The Green Valley Basin can be monitored at one point, located at the intersection of I-80 and I-680 near Cordelia. The U. S. Bureau of Reclamation currently monitors stream flows at this location with a Leopold Stevens A35 meter. The Bureau has agreed to make the necessary data available as soon as possible following a storm event.

The Green Valley Basin is also a likely growth area. The majority of the basin is undeveloped and it seems quite likely that growth will be rapid in the next 10 to 20 years. Thus, the use of this basin as the demonstration watershed will make it possible to supplement the on-going land use planning for this basin.

Sampling Procedures

The sampling of storm waters will involve the use of a Flow Proportioned Automatic Sampler to ensure that the rising leg of the hydrograph is adequately described. The sampler will be used during the early phases of the storm until a two-man crew can mobilize to take additional samples and to make velocity, temperature, and dissolved oxygen measurements.

The use of the sampler is essential to ensure that the number of false starts are reduced and that the storm is adequately characterized.

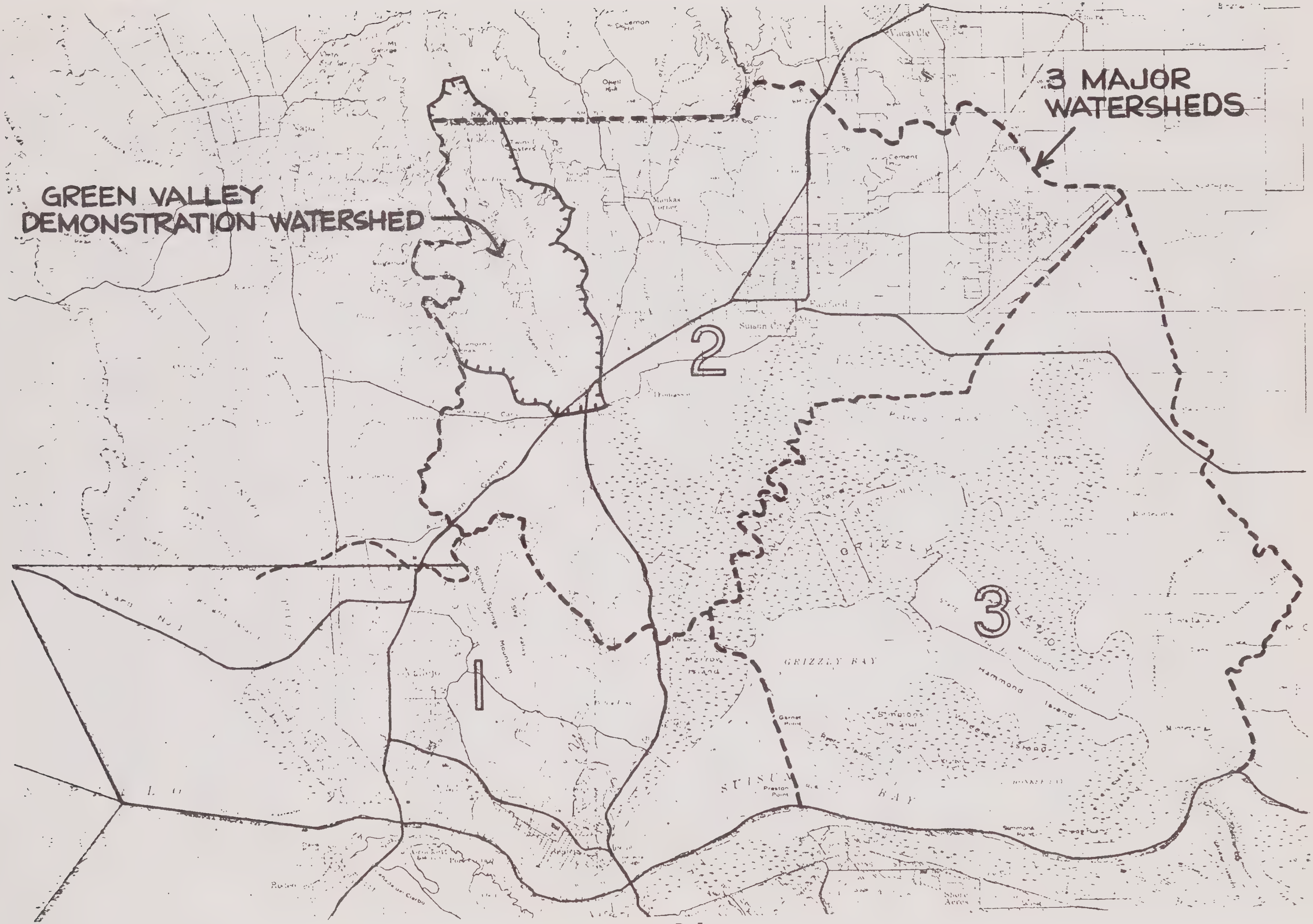


FIGURE B-1
GREEN VALLEY DEMONSTRATION WATERSHED

Water Quality Data

The following parameters will be monitored for up to three storm events:

Temperature	Total Dissolved Solids
BOD	Total Nitrogen (Kjeldahl N + NO_3 + NO_2)
Suspended Solids	Total Phosphorus
Volatile Suspended Solids	Lead

In addition, spot check analyses will be made for one storm:

Dissolved Oxygen	Fecal Streptococci
pH	Total Coliform
Fecal Coliform	Chlorinated Hydrocarbons (i.e. pesticides, herbicides)

Personnel

The sampling program will be directed by Dr. Larry L. Russell of James M. Montgomery, Consulting Engineers, Inc., located in Walnut Creek. Two teams of two engineers will stand by 24 hours on call. The data collection teams will not be available on December 24, 25, 31 and January 1. The automatic samplers will be available for data collection during these periods.

Equipment

Automatic Sampler	Dissolved Oxygen Meter
Flow Meter with proportional flow output	pH Meter
Sample bottles	Current Meter
Lighting	Automatic Rain Gauge

LONG-TERM DATA MONITORING

Need for a Long-Term Monitoring Program

The data collected during one rainy season is not adequate to provide all the information required for surface runoff planning. Among the objectives of a sampling program are:

° to characterize the response of the watershed with regard to both flow and water quality under a range of conditions

- ° to help in the identification of water quality problems that already exist or may occur in the future.
- ° to provide data for the calibration of the SWMM model, so that a variety of control measures and land use changes may be tested
- ° to assess the effects of implemented control measures

These objectives can be satisfied only by sampling over several seasons.

Sampling Sites

The Green Valley site chosen for the initial sampling should be maintained. It is a basically rural area that may undergo considerable growth in the near future. This makes it an ideal site for analyzing rural problems and control measures as well as monitoring the impacts of development and land use changes.

In addition to the Green Valley site, an urban monitoring station should be established, possibly in Fairfield. This station would be ideal for monitoring and analyzing urban water quality impacts and control measures. Fairfield is recommended because it drains into the environmentally sensitive Suisun Marsh and, therefore, deserves special attention.

Frequency of Sampling

The frequency of sampling is, of course, subject to the facilities of the county. A minimum program should consist of at least two storms during the wet season every year. It may also be helpful to collect one sample during the dry season for comparison and validation purposes.

Constituents to be Sampled

All constituents listed in the Water Quality Data Section of this memorandum should be included in all analyses. The urban samples should also be analyzed for oil and grease and an additional heavy metal, such as chromium. Rainfall and runoff must also be measured for all events.

Storms to be Monitored

An effort should be made to sample a variety of storms at both locations. This will allow a determination of the response of the watershed under different conditions and will be valuable for further calibration of the SWMM model.

Number of Samples Per Storm

The minimum number of samples should be six, with the majority of these

samples taken on rising limb of the hydrograph. The exact spacing of the samples will depend on the rate of rise of the hydrograph. In general, it is better to take extra samples on a uniform time basis, perhaps hourly, and then discard the excess samples based on review of the hydrograph. For instance, if the hydrograph is rising slowly, only every second or third sample would be analyzed.

Manpower Considerations

Either a consulting firm or experienced county personnel can supply the manpower for conducting the sampling. The consultant should have experience in storm water data collection and be familiar with the analytical techniques involved. Because Solano County presently does not have personnel qualified and experienced in water quantity and quality sampling, a training program would be required. The training of the County's staff would involve on-site seminars with hands-on data collection. One of the problems with the use of county personnel is the question of availability for sampling. These individuals would have other responsibilities which might preclude their availability during wet-weather periods.

Cost Considerations

A major consideration for a monitoring program is cost. Sampling equipment costs (i.e. wet-weather gear, lights, etc.) are approximately $250 per two-man crew. A rain gage is approximately $500 and a flow measurement facility in a storm drain could cost as much as $5,000 to construct and $1,000 to $2,000 to calibrate. Chemical analyses cost approximately $200 per sample for all those constituents shown in the Water Quality Data section, which totals about $1,200 per storm per station for the recommended six samples. The dry season sampling should be a 24-hour composite, and the analysis would cost approximately $200.

Labor costs are very significant, averaging approximately $750 for a two-man crew to collect samples at one station. Some reduction in cost may be realized if the county staff are utilized; however, training costs and overtime and/or holiday pay may offset any potential savings. In addition, the quality of data will be adversely affected if inadequately trained personnel are utilized.

PROGRAM RESULTS

Storms Sampled

The sampling at Green Valley Creek for the 1976-1977 season consisted of two storms: December 29-30, 1976 and January 1-2, 1977. The first storm produced over 2 inches of rainfall in a 24-hour period, but due to the extremely dry condition of the watershed very little runoff occurred. A peak flow of 20 cfs was measured during this December storm in a channel having a capacity of 2,000 cfs. Water quality samples taken during this storm were analyzed for the quality constituents indicated on the reporting

form appended to this memorandum. No quality data were collected for the January event, although the flow was recorded. This second storm produced over 2 inches of rain in 28 hours.

No other storms of sufficient magnitude to produce significant runoff occurred during the data collection period. The sampling equipment was maintained at the site until May 1977.

Equipment and Procedures

The rainfall data were collected with a Weathermeasure Tipping Bucket recording raingage, which is accurate to 0.01 inches. This gage was installed at Lake Madigan by Montgomery Engineers and maintained by the caretaker at the City of Vallejo reservoir.

Runoff was measured with a Leopold-Stevens A35 recording flow meter located on the east side of the I-680 on-ramp in Cordelia. This gage was installed by the U. S. Bureau of Reclamation, which supplied copies of the chart recordings and a preliminary rating curve for the site. The chart recordings were supplemented with measurements made by reading the staff gage located on the side of the Bureau's stream gage.

Sampling for the December storm was conducted with a stage activated ISCO automatic sampler. The sampler was set to activate at a stage equivalent to a flow of approximately 10 cfs. The sampler was only used to obtain the initial samples, and subsequent sampling was conducted using a hand-held sampler. All samples were acidified with 2 ml. of concentrated sulfuric acid to prevent bacterial degradation.

Sampling Results

Figures B-2 and B-3 present the rainfall hyetographs and the hydrographs for both storms. For the January storm, the rainfall for only the first 23 hours is shown (0.86 inches). The water quality data collected during the December storm are summarized below:

Constituent	Average mg/l	Range mg/l
Chemical Oxygen Demand	14.9	4 - 31
Total Nitrogen	2.6	1.6 - 3.1
Total Phosphorus	0.2	0.12 - 0.35
Suspended Solids	89	35 - 162
Lead	0.07	0.05 - 0.12

Analysis of Results

The Green Valley site was selected because of its rural nature and the U. S. Bureau of Reclamation stream gage. Unfortunately, after installation of the

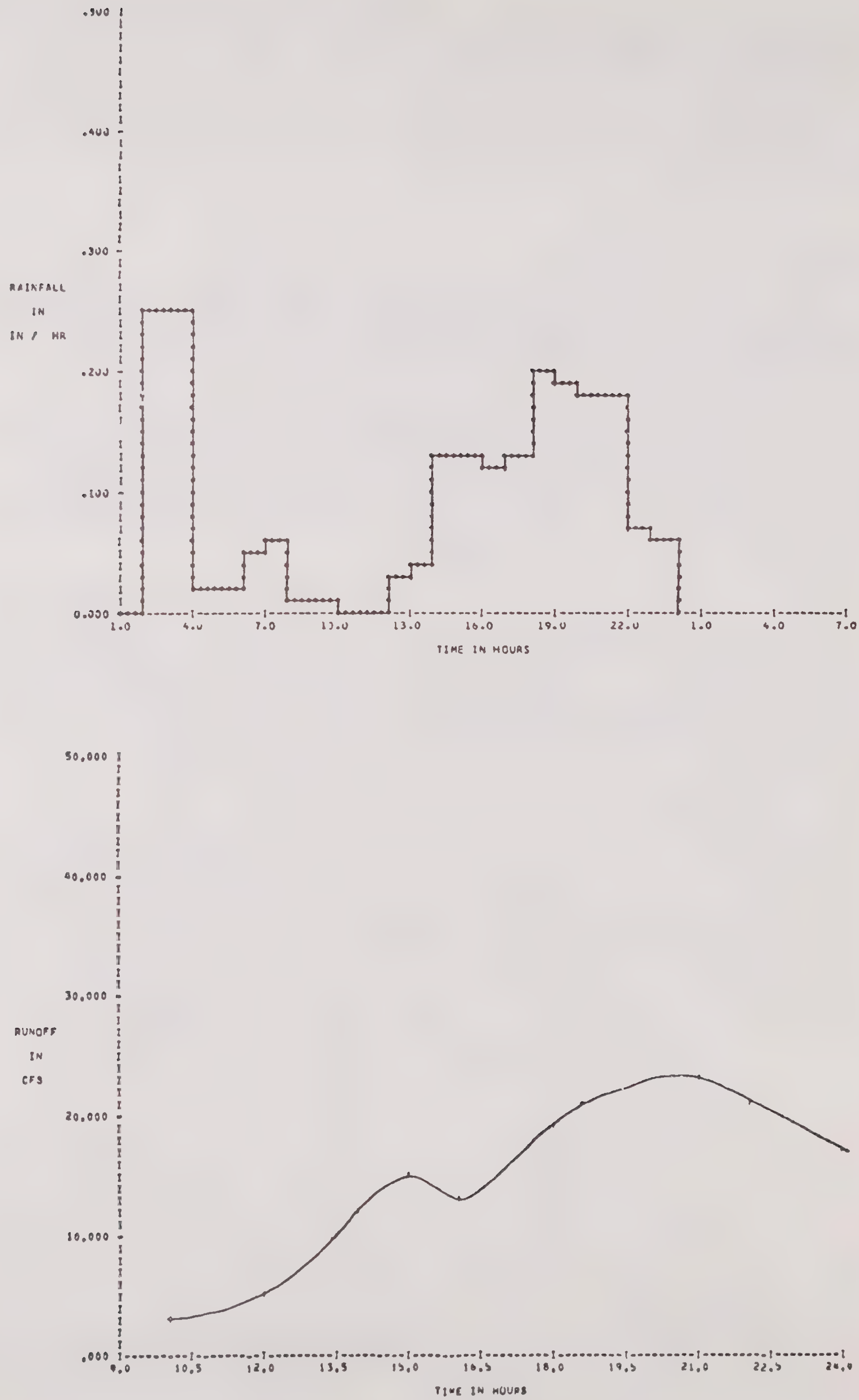


FIGURE B-2
HYETOGRAPH AND HYDROGRAPH
FOR STORM OF DECEMBER 29-30, 1976

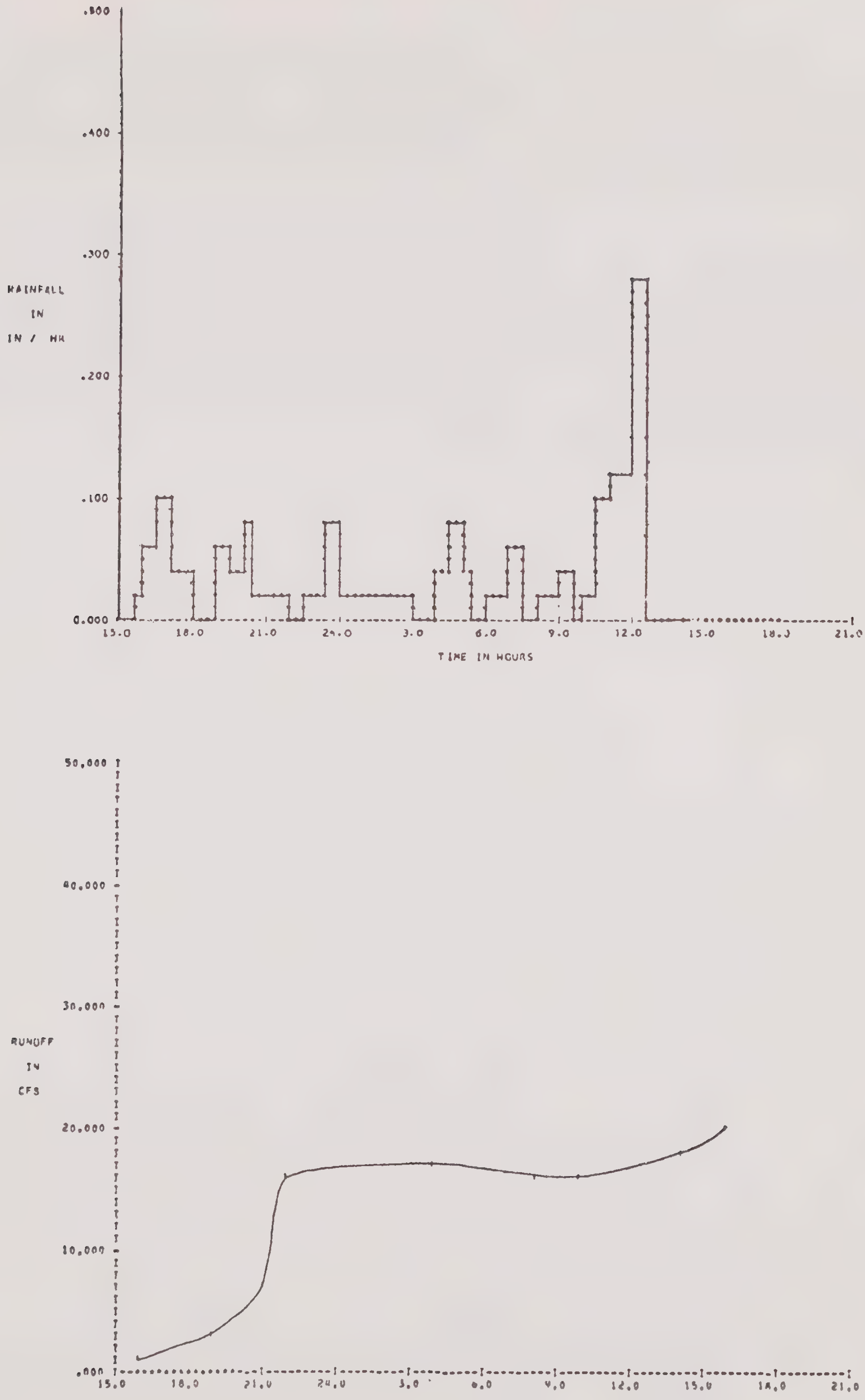


FIGURE B-3
HYETOGRAPH AND HYDROGRAPH
FOR STORM OF JANUARY 1-2, 1977

automatic sampler, the stage was observed to change up to 0.8 feet due to backwater conditions caused by tides in the Bay. This backwater could have affected flow measurements and possibly the water quality data. If further monitoring at this site is to be performed, consideration should be given to moving the gage further upstream to avoid potential backwater effects.

The significance of the collected data was further influenced by the nature of the wet season. Due to the abnormally dry conditions of the watershed prior to the storms, infiltration was rapid enough to absorb virtually all of the rain which fell on the pervious surfaces of the watershed. The minor flows measured appear to have come almost entirely from the small amount of impervious area located near the bottom of the watershed. For this reason, the quality data collected are probably unrepresentative of normal conditions. It is recommended that more storms be sampled before definite conclusions are drawn from the sampling program.

Appendix C
Modeling Program

Two levels of modeling analysis were made to help assess the nature and impacts of surface runoff in Solano County. For reasons to be discussed, the models were not used for their other major intended purpose: the assessment of alternatives for the control of runoff problems.

The first level model, the Metcalf and Eddy Macroscopic Planning Model or MAC model, looks at broad areas and long periods of record. Precision is sacrificed for breadth of coverage and for speed and flexibility in model application. The MAC model was applied to three major watersheds covering the entire study area. The second level, the EPA Storm Water Management Model (SWMM), is far more detailed and both site and storm specific. It was applied to a small demonstration watershed (Green Valley) and initially calibrated on the basis of two storms. The models are here further described and the data preparation and analysis of results reviewed.

MAC MODEL

Description of the Model

The Macroscopic Planning Model (MAC) is in fact a methodology to be used in the management of stormwater and consists of a series of interrelated tasks. These tasks are:

- Data preparation
- Rainfall characterization
- Storage-treatment balance
- Quality assessment
- Receiving water loading

The data preparation task consists of collecting information related to the characteristics of the drainage basin (area, land use, imperviousness, soil types, available storage, etc.) and the quantity and quality of runoff (for use in determining appropriate runoff and quality coefficients). Rainfall characterization involves the collection of rainfall records, correlation to the study area if required, characterization of discrete storm events, and statistical analysis of storm events. The storage-treatment balance task is accomplished by a computer program which converts rainfall to runoff by means of a gross runoff coefficient and can operate on either a daily or hourly time step basis. Provision for storage and treatment at a constant rate are built into the program. Quality assessment is a calculation that, for this study, consisted of segregating the available quality data on the basis of land use and averaging. Receiving water loadings are developed by combining the flows from the storage-treatment task and the concentrations from the quality assessment analysis.

Preparation of Data

The data required for the application of the MAC model to Solano County, as briefly stated above, included the characteristics of the drainage basin, hydrologic data (rainfall and runoff records), and quality data.

Basin Characteristics--the drainage basin analyzed with the MAC model consisted of that part of Solano County which drains directly into San Francisco Bay or any of its inland bays. The basin was divided into three major watersheds representing distinct population areas and/or physical characteristics: Vallejo-Benicia, Fairfield-Suisun, and Collinsville-Montezuma Hills (see Figure C-1). The land in each watershed was further separated into three subareas by general land use: natural or protected (A), nonurbanized but developable (B), and existing urban (C). (See Figure C-2). For each of these general land uses, the area, population, and effective percent imperviousness was determined for each of six specific land use categories.

1. Residential-single family
2. Residential-multiple family
3. Commercial
4. Industrial
5. Open space
6. Agricultural

MAC runs were made not only for current land use conditions, but also for projected conditions in 1985 and 2000, based on the ABAG Series III projections. The expected acreage changes by MAC watersheds are shown in Table C-1. The part of the study area in Napa County was not included in these figures.

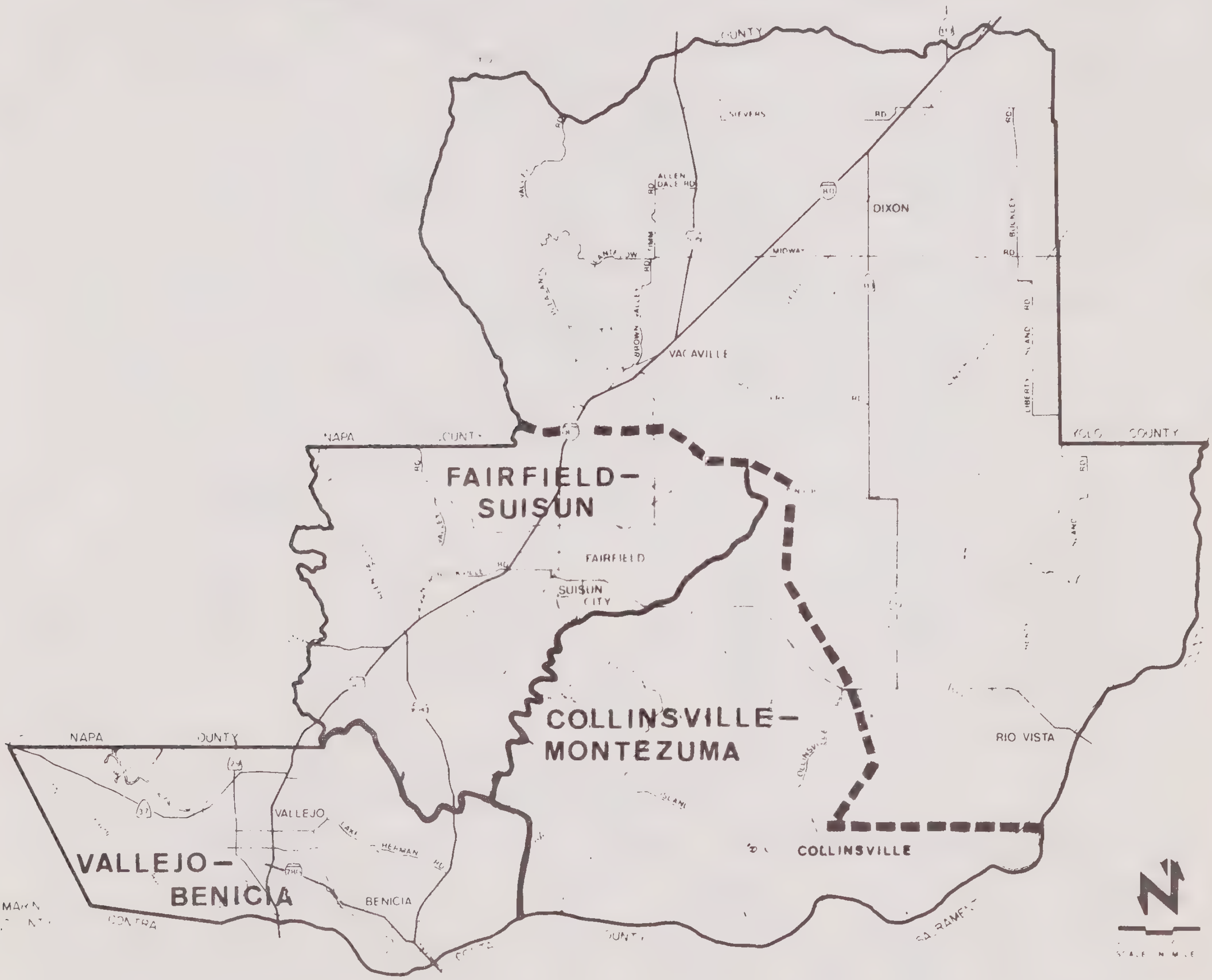
For the MAC simulations, no storage and treatment were assumed. This amounts to assuming that the storage levels of reservoirs will be approximately the same at the start and end of the simulation period. For computing annual runoff volumes, this is considered reasonable.

Hydrologic Data -- Gross runoff coefficients (runoff divided by rainfall) for the six specific land use categories were computed by ABAG based on streamflow and rainfall records in the Bay Area. These are shown in Table C-2. Due to a lack of streamflow data in Solano County, these figures could not be checked for local applicability.

Hourly rainfall records for Fairfield 3 NNE were obtained from U. S. Weather Bureau tapes for the period 1948-present. Rainfall at this location was used in all MAC runs.

Quality Data -- The quality data, consisting of average concentrations of each modeled constituent in storm runoff by land use, was taken from the monitoring program findings for Solano County and the other Bay Area counties. The assumption is that results for one part of the Bay Area may be applied to others having similar land uses. Since the sampling results show considerable variability from one area to another (particularly for open areas like Solano County), the results should be viewed cautiously. The quality coefficient used for the MAC runs are shown in Table C-2.

SOLANO COUNTY
SURFACE RUNOFF MANAGEMENT
PLANNING AREA



LEGEND

ABAG 208 STUDY AREA - - -
WATERSHED AREAS ——

FIGURE C-1

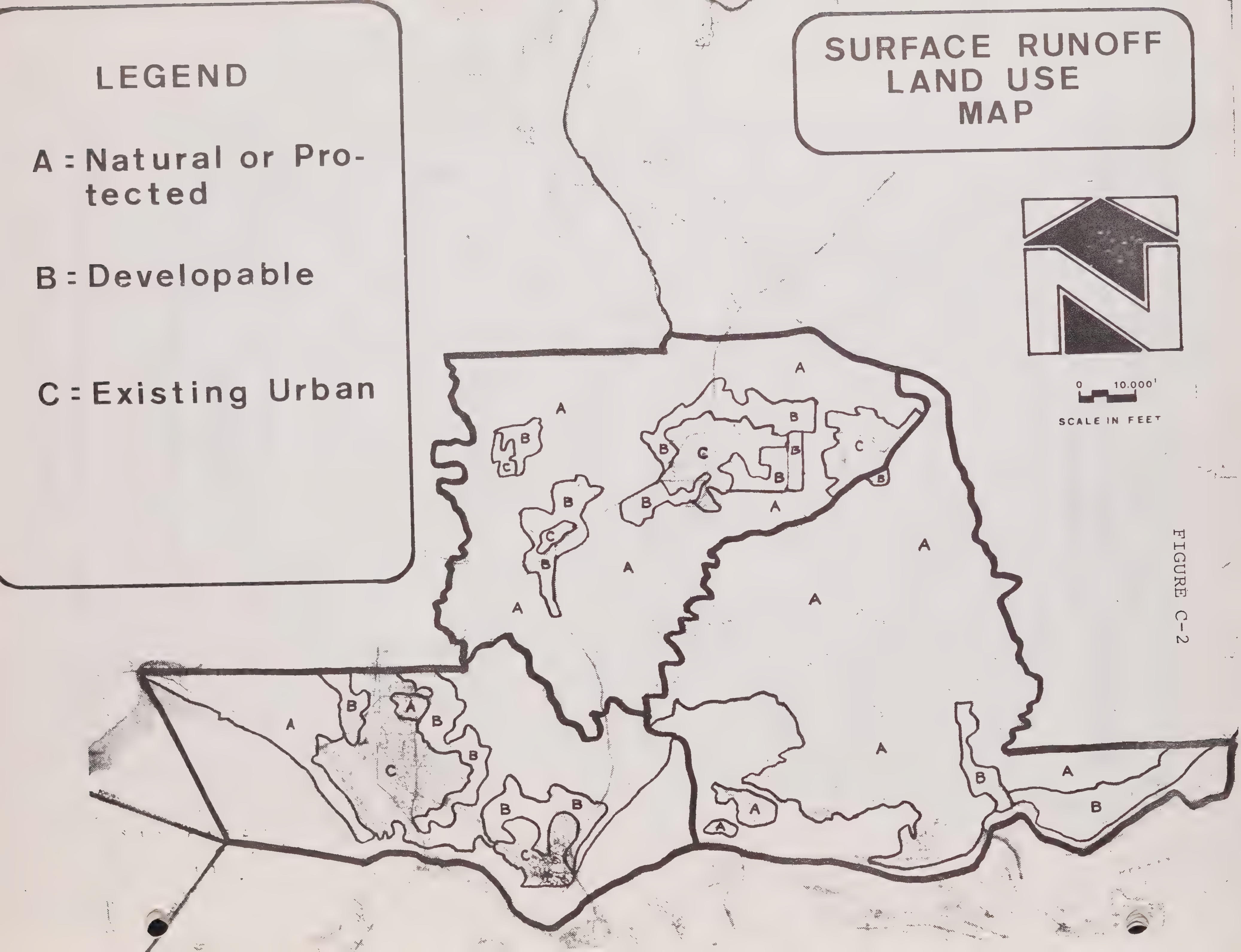

LEGEND
A = Natural or Protected
B = Developable
C = Existing Urban
SURFACE RUNOFF
LAND USE
MAP
0
10,000'
SCALE IN FEET

FIGURE C-2

TABLE C-1

ACREAGE CHANGES IN LAND USE CONDITIONS
by MAC WATERSHEDS
1975 to 1985   1985 to 2000

Vallejo-Benicia

Land Use	Base Year 1975	High Proj. 1985	Change 75-85	High Proj. 2000	Change 85-2000
Single Family	4881	8988	+4107	13747	+4759
Multiple Family	279	638	+ 359	1058	+ 420
Industrial	952	1210	+ 285	1552	+ 342
Commercial	1743	1813	+ 70	1895	+ 82
Open Space	38955	34159	-4796	28557	-5602

Fairfield-Suisun

Land Use	Base Year 1975	High Proj. 1985	Change 75-85	High Proj. 2000	Change 85-2000
Single Family	3055	5653	+2298	11605	+5952
Multiple Family	122	354	+ 232	799	445
Industrial	426	768	+ 342	936	+ 168
Commercial	1204	1309	+ 105	1622	+ 313
Open Space	77102	73826	-3276	66947	-6879

Collinsville-Montezuma Hills

Land Use	Base Year 1975	High Proj. 1985	Change 75-85	High Proj. 2000	Change 85-2000
Single Family	30	31	+ 1	34	+ 3
Multiple Family	1	1	0	1	0
Industrial*	1	17	+ 10	28	+11
Commercial	19	16	- 3	12	- 4
Open Space	90975	90969	- 6	90958	-11

*Possible future industrial sites along Sacramento River not included in these ABAG figures.

TABLE C-2

MAC RUNOFF AND QUALITY COEFFICIENTS

Land Use	Runoff Coef.	BOD_5	Total Suspended Solids	Total Volatile Solids	Total Nitrogen	Total Phosphorous
		(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
1. Residential-single	.30	15	200	25% of TSS	3.5	0.4
2. Residential-multi	.50	17-7	360	25% of TSS	3.5	0.4
3. Commercial	.90	20	150	70	5	0.7
4. Industrial	.90	13	120	50	3	0.5
5. Open	.20	4	500	15% of TSS	2	0.5
6. Agricultural	.20	4	500	15% of TSS	2	0.5

Results and Analysis

Using the above listed data, MAC runs were made for two rainfall years (1969-1970 and 1970-1971) and three land use configurations (1975, 1985, 2000). The results shown are for 1969-1970, a somewhat above average rainfall year. Table C-3 summarizes the total surface runoff loads by major watershed. Table C-4 gives the sum of the loads from the three major watersheds alongside the estimated point loads from municipal and industrial sources. These point source estimates assume no new treatment facilities or expansions of existing plants other than those already scheduled. Tables C-5 to C-7 give the breakdown by subarea (general land use) within each watershed. Figures C-3 and C-4 are plots depicting the expected changes in runoff loads with time and the estimates of the treated point source contributions. Figures C-5 to C-8 are plots of runoff loads by subarea over time. Tables C-8 to C-10 list the ranking of the contributions by subarea for the present and future land use conditions.

TABLE C-3

SURFACE RUNOFF POLLUTANT LOADS
(Thousand Pounds Per Year)

	Year	Vallejo-Benicia	Fairfield-Suisun	Collinsville
BOD	1975	426	501	304
	1985	517	580	304
	2000	622	730	305
TSS	1975	19,957	39,584	37,768
	1985	19,200	39,061	37,768
	2000	18,308	37,874	37,769
TN	1975	138	199	152
	1985	155	214	152
	2000	174	241	152
TP	1975	20	29	23
	1985	21	31	23
	2000	24	33	23

TABLE C-4

TOTAL POLLUTANT LOADS FOR THE THREE MAC WATERSHEDS
(Thousand Pounds Per Year)

		Surface Runoff	Point Sources	Total
BOD	1975	1,230	2,190	3,420
	1985	1,400	720	2,120
	2000	1,660	920	2,580
TSS	1975	97,300	2,500	99,800
	1985	96,000	1,300	97,300
	2000	94,000	1,300	95,300
TN	1975	490	880	1,370
	1985	520	960	1,480
	2000	570	1,270	1,840
TP	1975	72	310	382
	1985	75	670	745
	2000	80	940	1,020

TABLE C-5

MATHEMATICAL MODEL (MAC) RESULTS*
LAND USE YEAR 1975

WATERSHED	SUBAREA	WATERSHED CHARACTERISTICS	ACRES	ANNUAL POLLUTANT LOAD (1000's of LBS.) BOD	TSS	VSS	TOT N	TOT P
Vallejo Benicia	A	Cities of	22,398	82	9,806	1486	40	6
S1	B	Vallejo and	8,441	39	3,463	584	17	3
S1	C	Benicia	8,116	305	5,951	1418	81	11
		Totals for S1		426	19,957	3488	138	20
Fairfield	A	Cities of	61,318	242	29,953	4497	120	18
S2	B	Fairfield and	10,248	68	5,289	839	27	4
S2	C	Suisun	5,536	191	4,342	945	52	7
		Totals for S2		501	39,585	6281	199	29
Collinsville	A	Open Space	83,829	280	34,800	5224	140	21
S3	B		7,146	24	2,968	446	12	2
		Total for S3		304	37,768	5670	152	23

*Rainfall year 1969/70

TABLE C-6

MATHEMATICAL MODEL (MAC) RESULTS*
LAND USE YEAR 1985

WATERSHED	SUBAREA	WATERSHED CHARACTERISTICS	ACRES	ANNUAL POLLUTANT LOAD (1000's of LBS.) BOD	TSS	VSS	TOT N	TOT P
Vallejo Benicia	A	Cities of	21,934	92	9,806	1490	42	6
S1	B	Vallejo and	5,644	107	3,463	631	31	4
S1	C	Benicia	6,581	318	5,951	1346	82	11
		Totals for S1		517	19,220	3467	155	21
Fairfield	A	Cities of	61,033	251	29,953	4507	122	18
S2	B	Fairfield and	7,003	154	5,289	890	27	6
S2	C	Suisun	5,790	175	4,342	905	52	7
		Totals for S2		580	39,061	6302	214	31
Collinsville	A	Open Space	83,824	280	34,800	5224	140	21
S3	B		7,145	24	2,968	446	12	2
		Totals for S3		304	37,768	5670	152	23

*Rainfall year 1969/70

WATERSHED	SUBAREA	CH
Vallejo Benicia	A	Ci
S1	B	Val
S1	C	Ben
		Tot
Fairfield	A	Citi
S2	B	Fair
S2	C	Suis
		Total
Collinsville	A	Open
S3	B	
		Totals

*Rainfall year 1969/70

SOLANO COUNTY PUBLIC WORKS DEPARTMENT

COMPARISON OF POINT AND NON POINT POLLUTION LOADS MAC WATERSHED

FOR THE YEARS OF 1975, 1985, 2000 VALLEJO-BENICIA

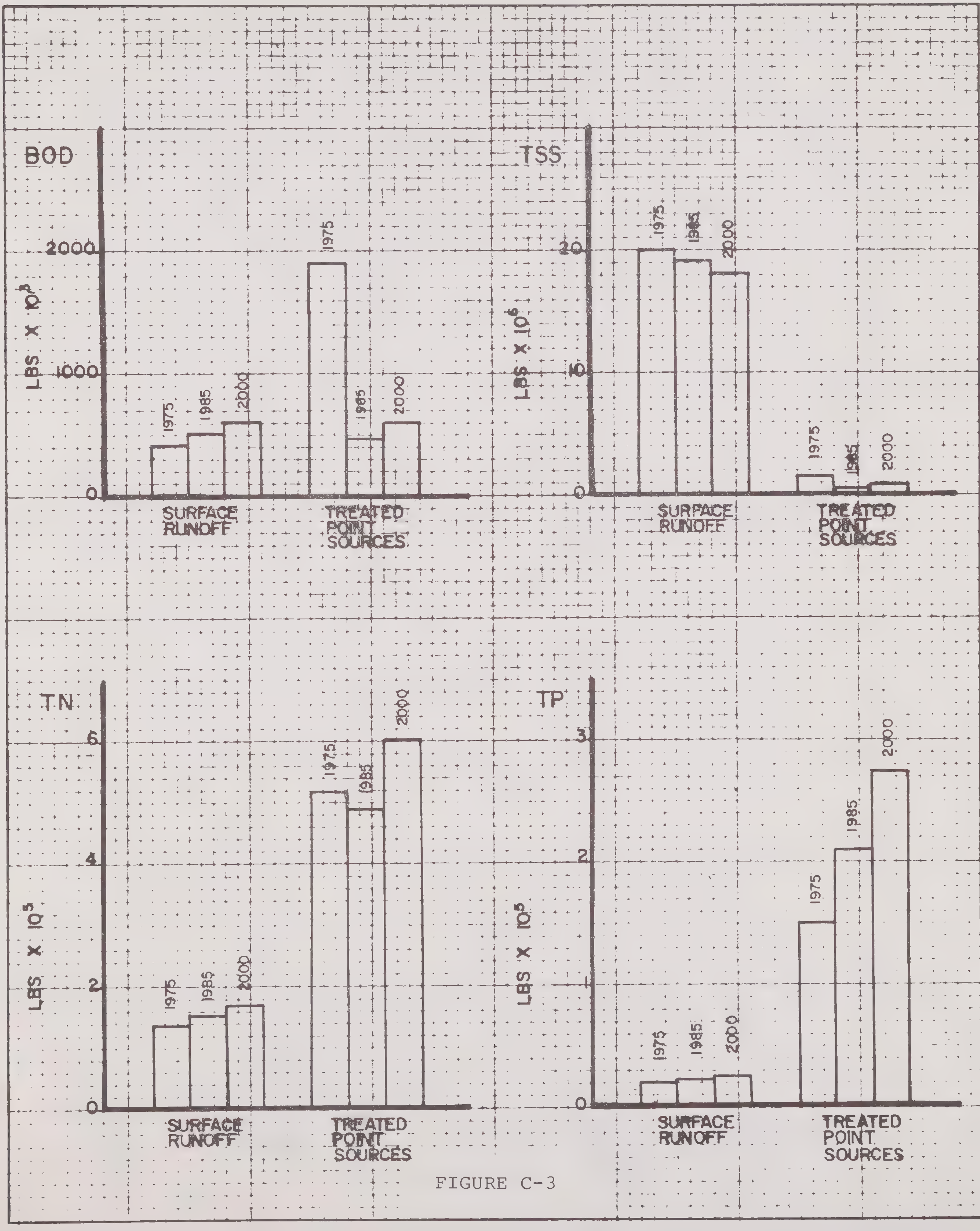


FIGURE C-3

SOLANO COUNTY PUBLIC WORKS DEPARTMENT
COMPARISON OF POINT AND NON POINT POLLUTION LOADS MAC WATERSHED
FOR THE YEARS OF 1975, 1985, 2000 FAIRFIELD - SUISUN

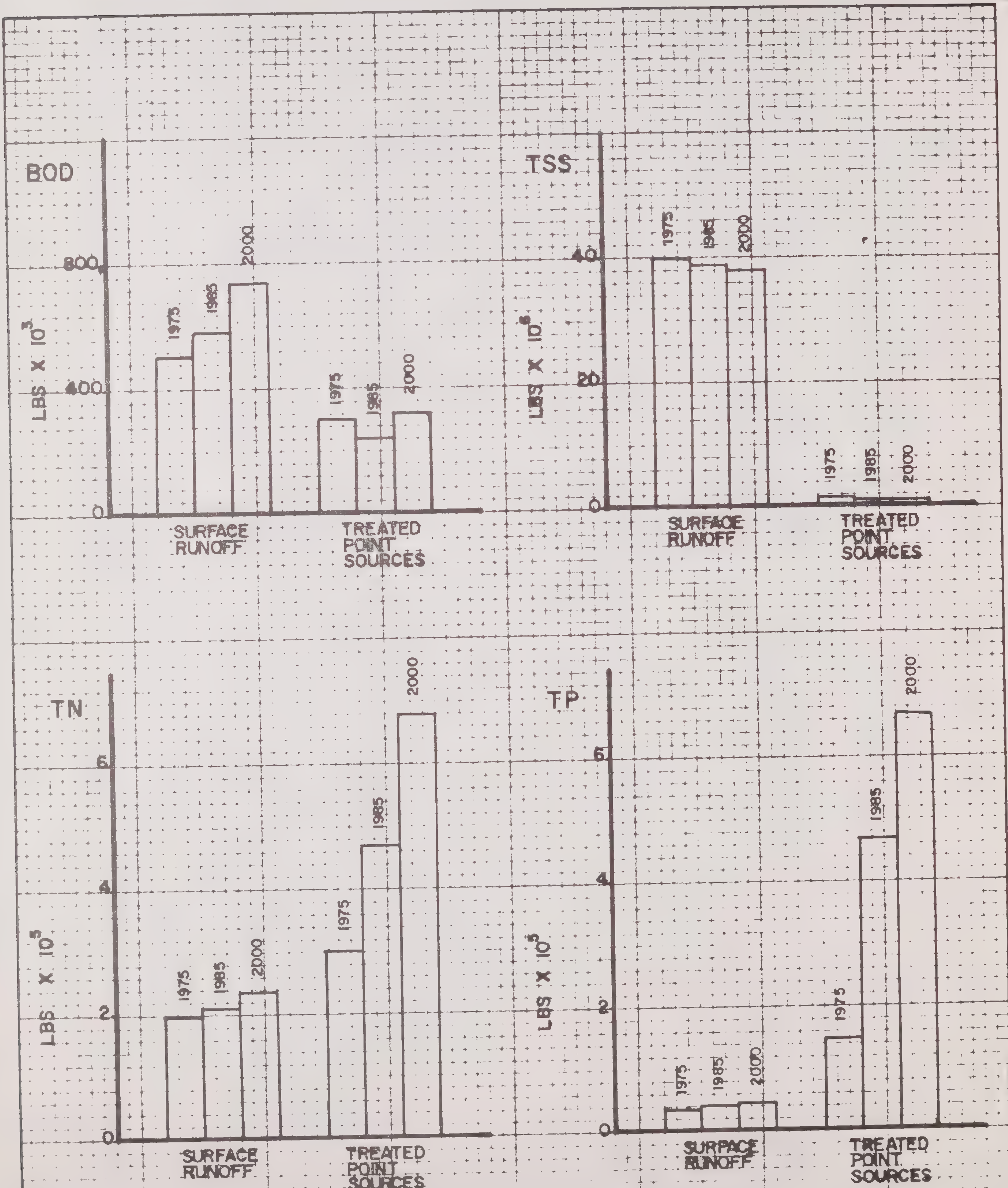


FIGURE C-4

SOLANO COUNTY PUBLIC WORKS DEPARTMENT
COMPARISON OF SUBAREA POLLUTION LOADS MAC WATERSHED
FOR THE YEARS OF 1975, 1985, 2000 SUBAREAS A,B,C VALLEJO-BENICIA

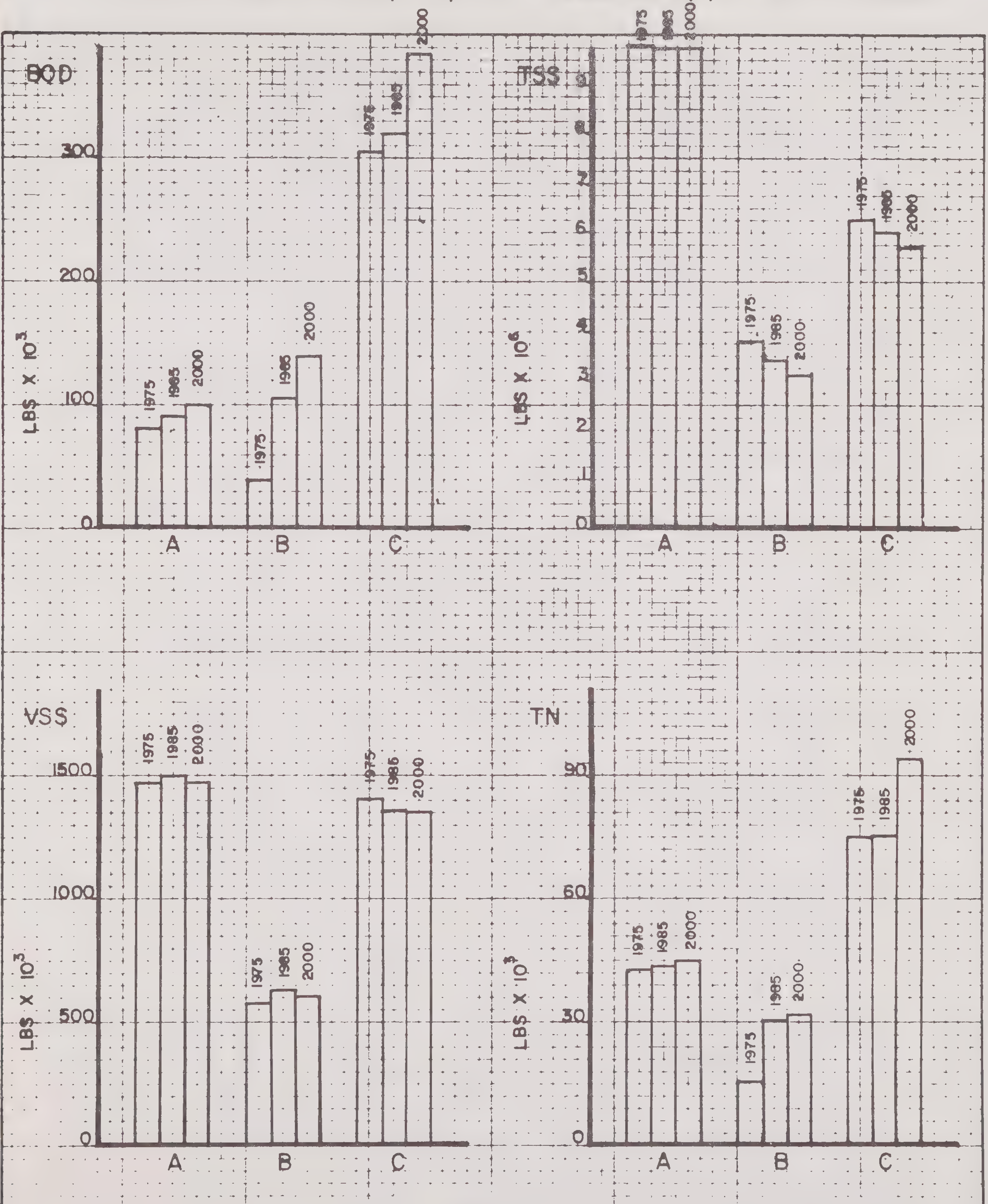


FIGURE C-5

SEE PAGE FOR TP

SOLANO COUNTY PUBLIC WORKS DEPARTMENT
COMPARISON OF SUBAREA POLLUTION LOADS MAC WATERSHED
FOR THE YEARS OF 1975, 1985, 2000 SUBAREAS A,B,C FAIRFIELD-SUISUN

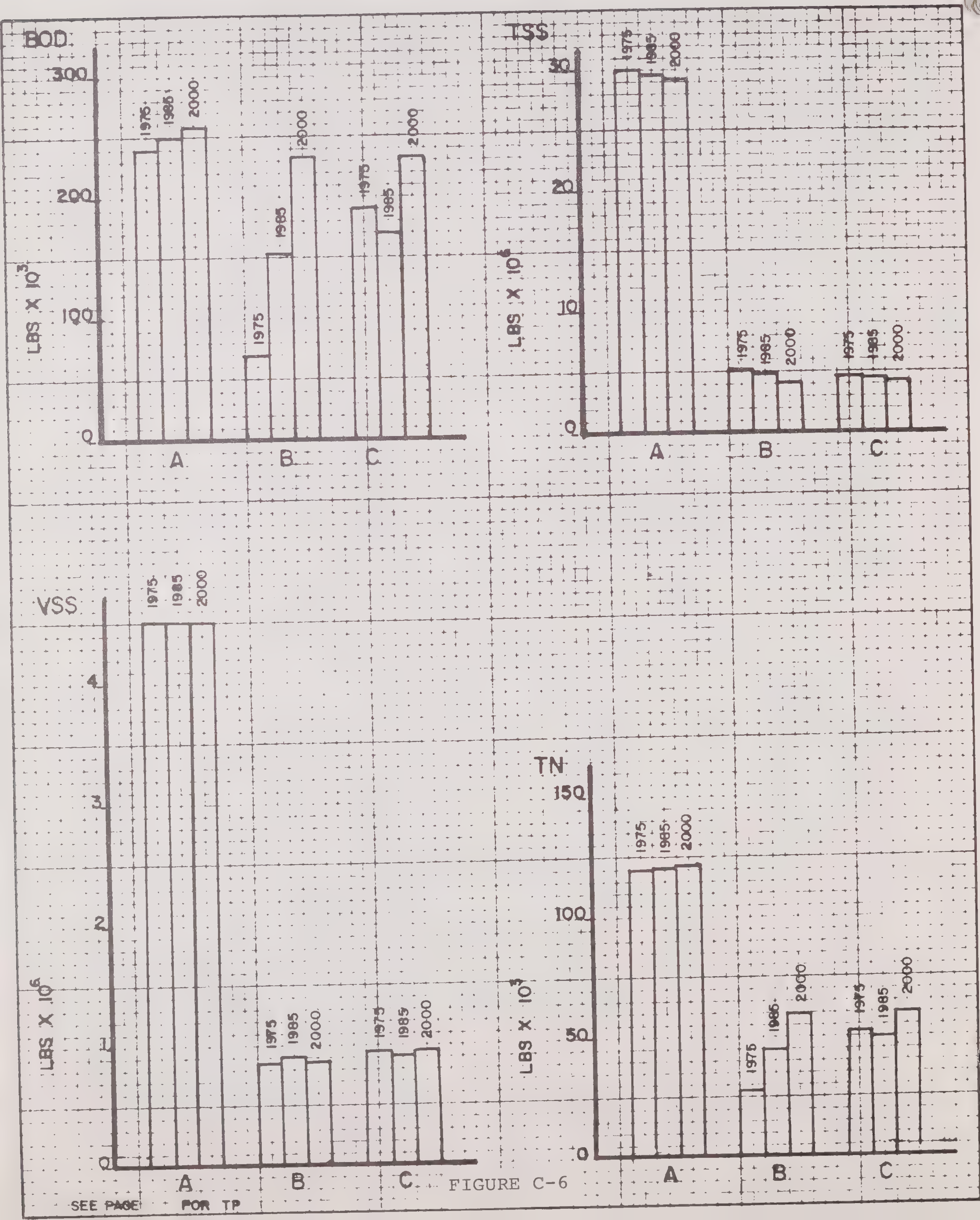
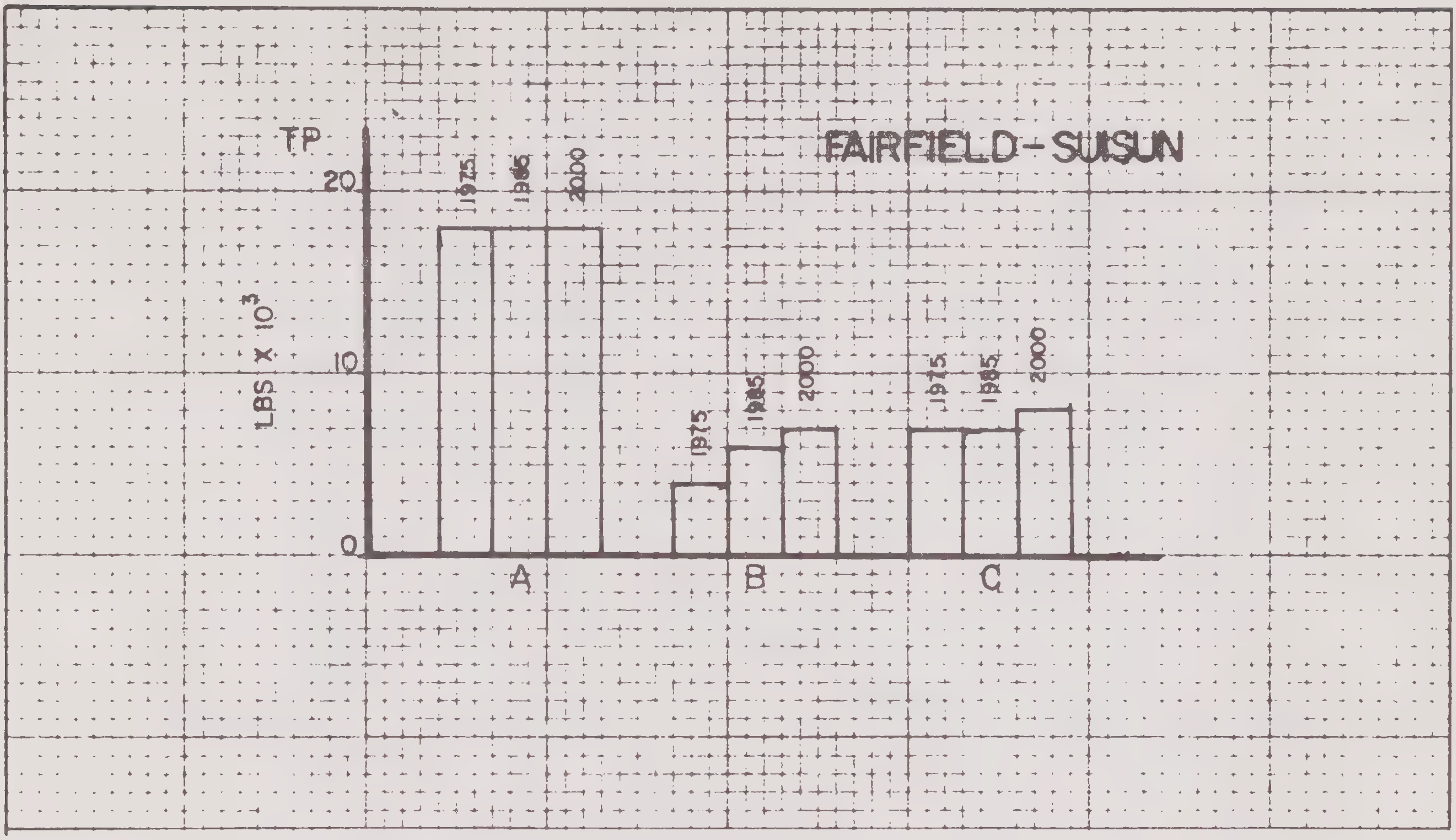


FIGURE C-6

SEE PAGE FOR TP

SOLANO COUNTY PUBLIC WORKS DEPARTMENT

COMPARISON OF SUBAREA POLLUTION LOADS MAC WATERSHED
FOR THE YEARS OF 1975, 1985, 2000 SUBAREAS A,B,C



COMPARISON OF SUBAREA POLLUTION LOADS MAC WATERSHED
FOR THE YEARS OF 1975, 1985, 2000 SUBAREAS A,B,C

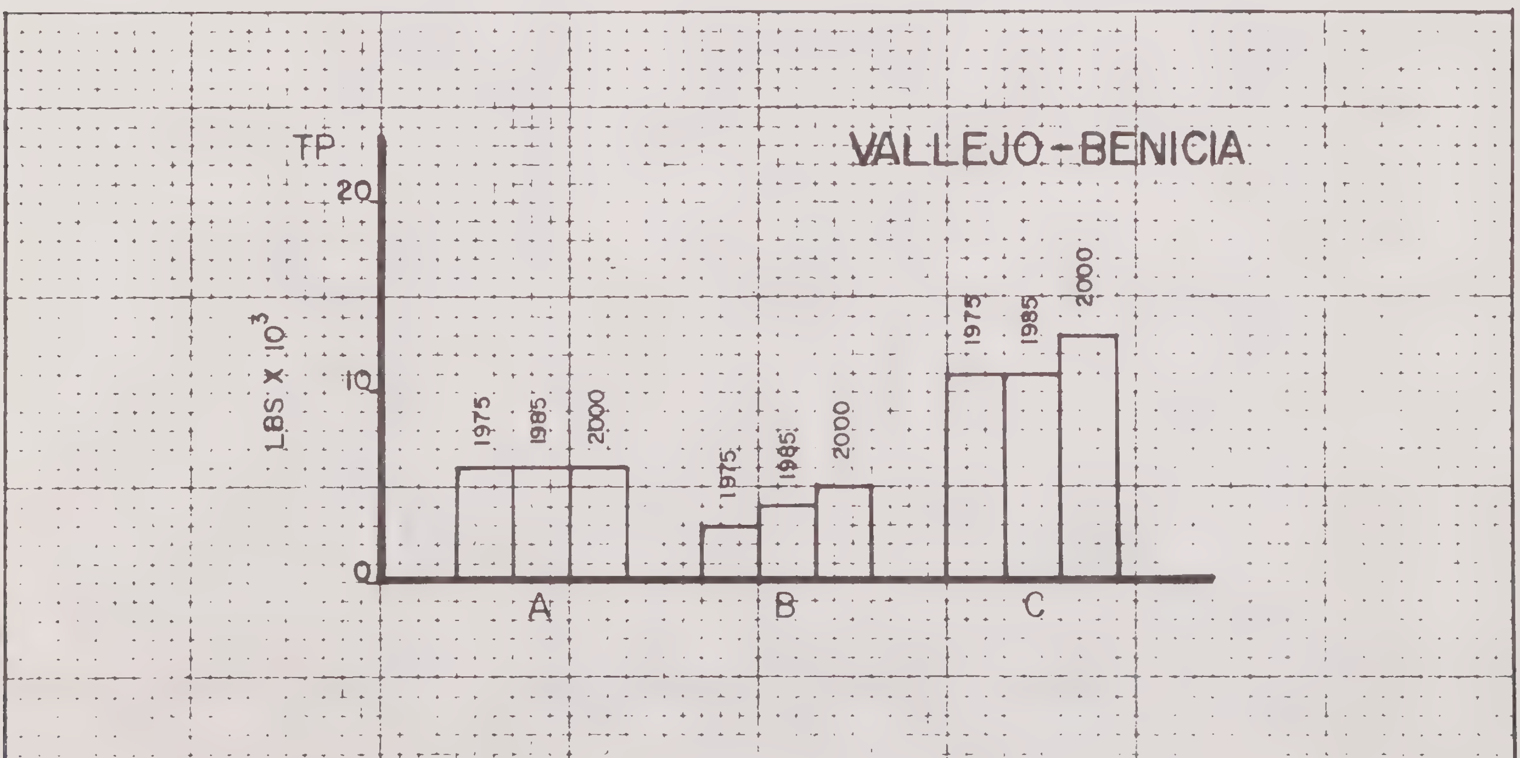


FIGURE C-7

SOLANO COUNTY PUBLIC WORKS DEPARTMENT
COMPARISON OF SUBAREA POLLUTION LOADS MAC WATERSHED
FOR THE YEARS OF 1975, 1985, 2000 SUBAREAS A,B COLLINSVILLE

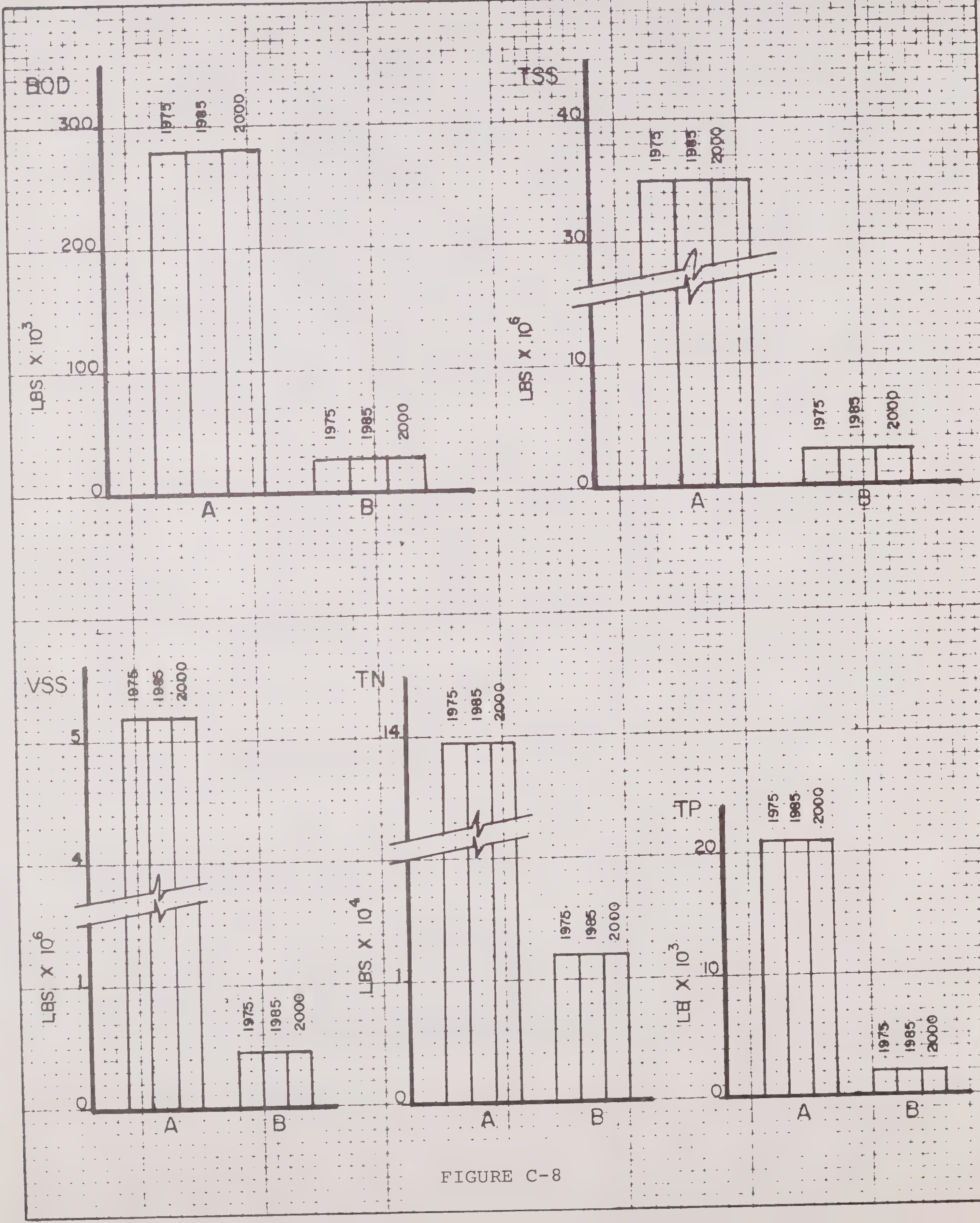


FIGURE C-8

TABLE C-8

RANKING OF CONTRIBUTION OF SUB-AREAS
TO TOTAL COUNTY POLLUTANT LOADINGS
LAND USE YEAR 1975*

	BOD		TSS		VSS		TN		TP	
Rank	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed
1	C	S1	A	S3	A	S3	A	S3	A	S3
2	A	S3	A	S2	A	S2	A	S2	A	S2
3	A	S2	A	S1	A	S1	C	S1	A	S1
4	C	S2	C	S1	C	S1	C	S2	C	S2
5	A	S1	B	S2	C	S2	A	S1	A	S1
6	B	S2	C	S2	B	S2	B	S2	B	S2
7	B	S1	B	S1	B	S1	B	S1	B	S1
8	B	S3	B	S3	B	S3	B	S3	B	S3

*Rainfall year 1969/70

TABLE C-9

RANKING OF CONTRIBUTION OF SUB-AREAS
TO TOTAL COUNTY POLLUTANT LOADINGS
LAND USE YEAR 1985*

	BOD		TSS		VSS		TN		TP	
Rank	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed
1	C	S1	A	S3	A	S3	A	S3	A	S3
2	A	S3	A	S2	A	S2	A	S2	A	S2
3	A	S2	A	S1	A	S1	C	S1	C	S1
4	C	S2	C	S1	C	S1	C	S2	C	S2
5	B	S2	B	S2	C	S2	B	S2	A	S1
6	B	S1	C	S2	B	S2	A	S1	B	S2
7	A	S1	B	S1	B	S1	B	S1	B	S1
8	B	S3	B	S3	B	S3	B	S3	B	S3

*Rainfall year 1969/70

TABLE C-10

RANKING OF CONTRIBUTION OF SUB-AREAS
TO TOTAL COUNTY POLLUTANT LOADINGS
LAND USE YEAR 2000*

	BOD		TSS		VSS		TN		TP	
Rank	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed	Sub-area	Water-shed
1	C	S1	A	S3	A	S3	A	S3	A	S3
2	A	S3	A	S2	A	S2	A	S2	A	S2
3	A	S2	A	S3	A	S1	C	S1	C	S1
4	C	S2	C	S1	C	S1	C	S2	C	S2
5	B	S2	B	S2	C	S2	B	S2	B	S2
6	B	S1	C	S2	B	S2	A	S1	A	S1
7	A	S1	B	S1	B	S1	B	S1	B	S1
8	B	S3	B	S3	B	S3	B	S3	B	S3

*Rainfall year 1969/70

The Vallejo-Benicia watershed is the smallest of the three, but it contains the largest amount of existing urban land. Currently, it produces the major point loads, anywhere from 52 to 86 percent of the total basin point load depending on constituent. However, these percentages will drop to 28 to 65 percent before 2000 due partly to the construction of a new minicipal treatment plant which is anticipated to reduce BOD loads to 25 percent of present levels. The Vallejo-Benicia surface runoff loads are presently 20 to 35 percent of the basin total and will maintain approximately this percentage to the year 2000 (20 to 38 percent). By 2000, the surface runoff loads will increase from 20 to 31 percent (consistuent dependent) for BOD, nitrogen, and phosphorus, while suspended solids will decrease 8 percent as more sediment producing open space is converted to urban lands. More than 50 percent of this increased load will come from the developable land area, with most of the remainder from existing urban areas. (See Figure C-2).

Slow, steady development is expected in the Fairfield-Suisun watershed, although this development will involve a relatively small percentage of the total land area. Currently, it produces only 14 to 48 percent of the basin point loads, but this will increase to 35 to 72 percent by 2000 unless improved treatment facilities are constructed. The surface runoff loads comprise 40 to 41 percent (constituent dependent) of the basin total and this will stay about the same to 2000 (40 to 44 percent). The surface runoff loads will increase 14 to 31 percent for BOD, nitrogen, and phosphorus, while suspended solids will decrease 4 percent as more open space is converted to urban land. About 75 percent of this increased load will come from the developable land, most of the remainder from existing urban areas. (See Figure C-2).

Very little development of the Collinsville-Montezuma Hills watershed is expected since the protected Suisun Marsh makes up most of the watershed. Almost all of the pollution load of the parameters evaluated here occur from surface runoff, which accounts for 24 to 39 percent of the basin total and is expected to account for 18 to 40 percent by 2000. The general slight decrease in percentage is due to the fact that the loads will not change here but will increase in the other watersheds. The exception to this rule is suspended solids, which decrease in the other watersheds.

Overall, for the three watersheds, point sources currently comprise 64 percent of the total BOD load (point sources plus surface runoff), 2.5 percent of the suspended solids, 64 percent of total nitrogen, and 81 percent of total phosphorus. These percentages will be 36 percent, 1.3 percent, 69 percent, and 92 percent in 2000, reflecting the increasing importance of BOD in surface runoff relative to point sources. This trend may be seen with nitrogen and phosphorus as well if new advanced treatment plants are built to control point loads, which is likely. Suspended solids, it can be seen, is essentially a surface runoff problem. The major implications of the MAC results are:

- Surface runoff loads are significant relative to point loads and will increase in significance in the future as point sources are controlled and increased development adds to non-point sources.

- Most of the increase in surface runoff loads will come from developable land as opposed to existing urban land.

- A large fraction of the surface runoff load, particularly suspended solids, comes from natural areas due to erosion.

In drawing conclusions from MAC simulations, though, the weaknesses of its approach must be kept in mind. The assumption that all open areas can be characterized by a single runoff coefficient and runoff quality is particularly limiting in Solano County, which is largely open space. Soil type, erodibility, and type of rural land use are crucial to the resulting quality of runoff and are probably much more variable than the factors which determine urban runoff quality. This weakness was born out by the findings of the sampling programs, which showed very wide scatter in the suspended solids concentrations from primarily open areas, whereas the concentrations from urban land uses tended to show more uniformity in all counties. Until more data is collected in Solano County, the MAC results for open lands must be viewed very cautiously.

SWMM MODEL

Description of Model

The Storm Water Management Model (SWMM) is a detailed site and event-specific model that computes the runoff and runoff quality from a watershed. The key differences between the MAC and SWMM models are:

1. SWMM is much more detailed than MAC and therefore requires more input data (e.g. infiltration rates, subcatchment slopes and roughness, channel size, slope and roughness, quality data for pollutant buildup, soil loss parameters, etc.)

2. SWMM is applicable to a single event per run.

3. SWMM operates on a short-time step (5-30 minutes) and produces a detailed hydrograph and pollutograph for the storm at many different points in the storm network.

4. The methods used to compute runoff and runoff quality are much more sophisticated than in MAC and several parameters must be defined for a particular watershed. Therefore, calibration to existing data is required.

5. Due to its level of detail, the SWMM model may be used to better assess the effects of more control measures than can be done using MAC.

The area to be modeled is first broken up into several smaller subcatchments which are fairly uniform in slope, cover, soil type, and land use. If appropriate, different rainfall hyetographs may be applied to different subcatchments. Each subcatchment is idealized as a rectangular plane from which the rain may either flow off (impervious areas) or infiltrate at a

declining rate, the excess flowing off. Before any water runs off, depression storage must be satisfied. The rate at which the water enters a drainage channel and, in turn, flows through the channels, depends on the slope and roughness of the surfaces involved.

The quality calculations are done in two different ways--a time-dependent dust and dirt buildup and runoff-dependent washoff routine for urban land uses and a modified universal soil loss equation for rural areas. The rate of buildup and washoff of dust and dirt and the relationship between dust and dirt and various pollutants is taken from national averages but usually modified in the calibration process to match observed data. Soil loss factors must also be adjusted although guidelines for these values based on soil type, crop cover, management practices, etc. are available.

The observed runoff hydrograph can usually be matched quite well using SWMM, especially in urban areas, but the quality simulations tend to yield only fair results. This reflects the state-of-the-art with respect to storm water modeling. After the model has been calibrated, the effect of several control strategies may be tested by varying one or more of the many model parameters.

Preparation of Data

The Green Valley watershed (Figure B-1) was selected as Solano County's demonstration watershed for the application of the SWMM model. The selection criteria set forth by ABAG and a rating of Green Valley follow.

Criteria	Rating of Green Valley Creek
1. Local Significance	
a. Beneficial Use Areas:	Water-oriented recreation fresh-water habitat
b. Growth Areas:	Change from Ag and Open Space to Residential
c. Problem Areas:	Septic tank problems caused by high water table
d. Control Measure Testing Areas:	Control measures applicable to residential subdivisions
2. Results Applicable to Unmodeled Watersheds	
a. Watershed Size:	Typical for Solano County
b. Homogeneous Land Use:	Rural, limited residential
c. Types of Control Measures Tested:	Variety can be tested

3. Model Result Reliability

a. Streamflow Data	USBR has streamflow gage
b. Water Quality Data	None
c. Rainfall Data	Hourly gage at Fairfield (5 miles to the east)
d. Suitability to Water Quality Sampling Program	Good

Procedures used in measuring the physical characteristics of the watershed subareas and the runoff conveyance facilities are given below, and are in accordance with the procedures set forth in the Version II User's Manual.

Subarea

1. Width	USGS Quad Map
2. Area	Planimetered from USGS Quad Map
3. Percent Impervious	Data from ABAG's 1976 Sonoma County Study
4. Slope	Average slope from USGS Quad Map
5. Resistance Factor	User's Manual Version II
6. Surface Storage	User's Manual Version II
7. Infiltration	SCS Soil Report

Gutter

1. Bottom Width	Field Measurement
2. Length	USGS Quad Map
3. Slope	USGS Quad Map
4. Side Slopes	Field Measurement
5. Manning's Coef.	Field Inspection
6. Depth	Field Measurement

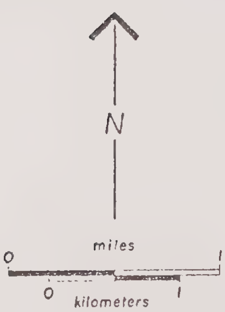
Erosion

1. Area Subject to Erosion	USGS Quad Map
2. Flow Distance	USGS Quad Map
3. Soil Factor	Based upon SCS soil type
4. Cropping Management Factor	Estimated
5. Control Practice Factor	Assigned by ABAG

Surface Quality

1. Length of Gutters Within Subarea	Estimated from field inspection

The SWMM Version II User's Manual criteria were used for delineating watershed



GREEN VALLEY CREEK
DEMONSTRATION WATERSHED

WATER RESOURCES ENGINEERS
710 SOUTH BROADWAY
WALNUT CREEK, CALIFORNIA 94596

BY DAP	APPROVED	DATE DEC '76
		UPDATED 14 JAN 77

FIGURE C-9
GREEN VALLEY WATERSHED SUBAREAS
AND DRAINAGE CHANNELS

subareas. Because of the size and complexity of the Green Valley Creek watershed, it was necessary to define subareas in a "fine" approach as opposed to a "coarse" discretization (refer to User's Manual, Page 45). In applying the "fine" approach, consideration was given to overland flow patterns, configuration of the stream/gutter system, land use, and subarea size. See Figure C-9 for the breakdown of subareas and drainage channels.

The preparation of land use data:

1. Source of data: Land use information for the ABAG 208 study area was derived from ABAG's 1975 land use data base for Series III Projections. Where ABAG's 440 Zone configuration did not correlate with the watershed boundaries, available data from Solano County Planning publications was used. Proposed 1990 land use was obtained by computing the difference between ABAG's 1975 data base and its 1990 high land use projections. This material was supplemented by material from jurisdictional general plans and recent land use projections prepared by the Solano County Transportation Council.

2. Smallest land use unit: 2 square miles

3. Single-family Residential:

    1 to 4 dwelling units per acre

    One family residence (R-S) Districts

    (Urban single family homes and the community services appurtenant thereto)

   Multiple Family Residential:

    5 to 20 dwelling units per acre

    Includes: Duplex Residential (R-D) Districts (Medium Density) and multiple residence (R-M) Districts (High Density).

   Commercial:

    Includes the following categories:

    Highway Commercial (C-H) Districts
    Neighborhood Commercial (C-N) Districts
    General Commercial (C-G) Districts
    Commercial Service (C-S) District
    Business and Professional Office (C-O) Districts

   Industrial:

    Includes the following categories:

    Limited Manufacturing (M-L) Districts
    General Manufacturing (M-G) Districts

Open Space:

Park (P) Districts

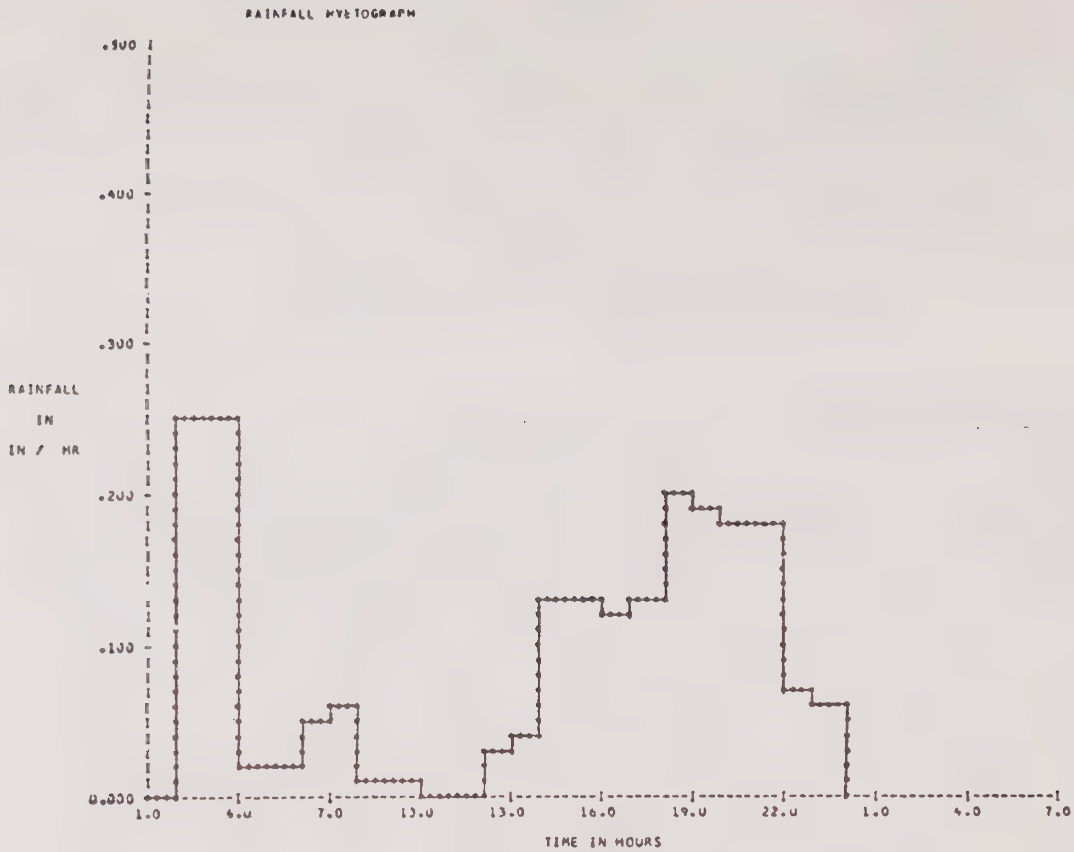
Agricultural:

Includes the following categories:

Exclusive Agriculture (A) Districts
Agricultural-Residential (A-R) Districts

Results and Analysis

Only two storms were sampled in 1976-77, and only one for water quality. The fact that Green Valley is largely rural and that the soil moisture was extremely low when the storms occurred caused unrepresentatively low flows. Figure C-10 and C-11 show the rainfall and the simulated and observed runoff. The observed flows were about the same for both storms in spite of the lower rainfall intensities of the second storm. This is probably due to higher runoff from pervious surfaces during the second storm as a result of higher soil moisture prior to the storm. Better results could have been obtained by reducing the impervious percentages for both events, while lowering the infiltration rate for the second storm only. This points out a basic weakness of the SWMM model-inability to consider the effect of initial soil moisture on infiltration. This drawback was especially important in this case since the antecedent conditions for these two storms were very different. More data collected under more representative conditions could establish calibration parameters that could be applied to achieve good "average condition" simulations. Further monitoring at this location, as part of the continuing planning program, could provide this needed data and also provide quality data which could be used for quality calibration, unattempted as yet. Once the model is calibrated to average local conditions, it could then be a useful tool in evaluating some control measures.



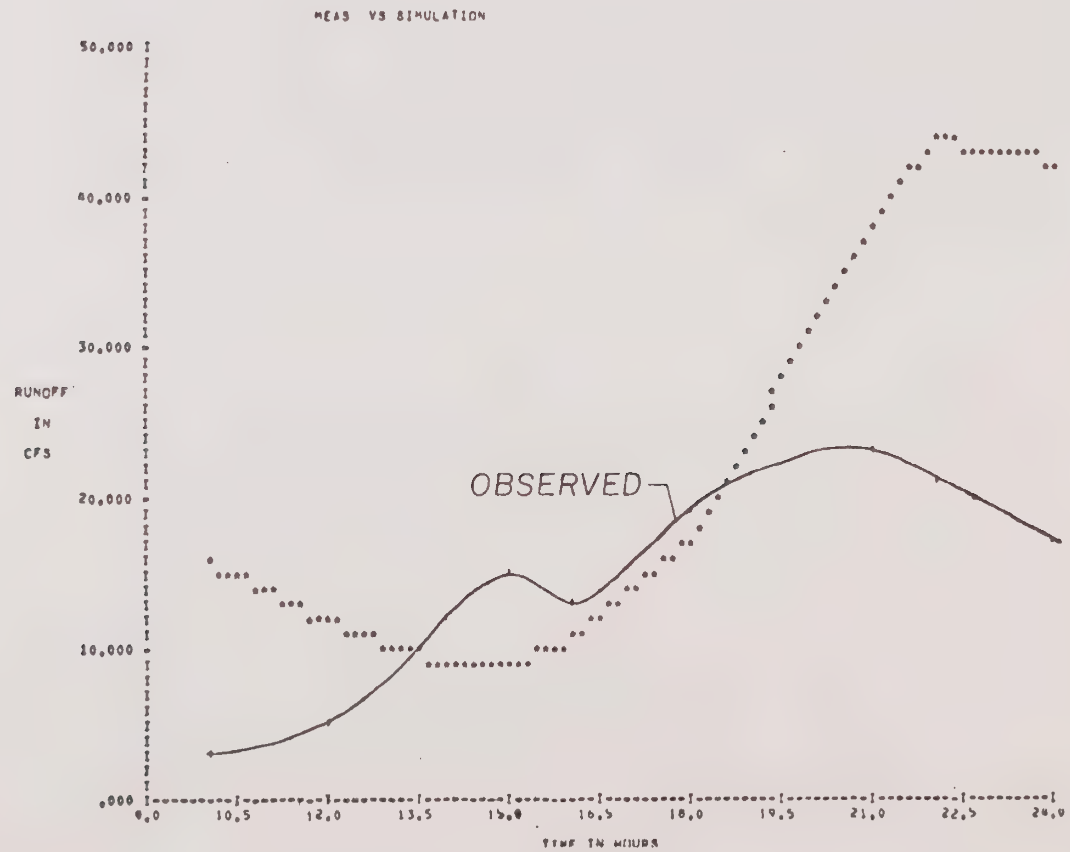
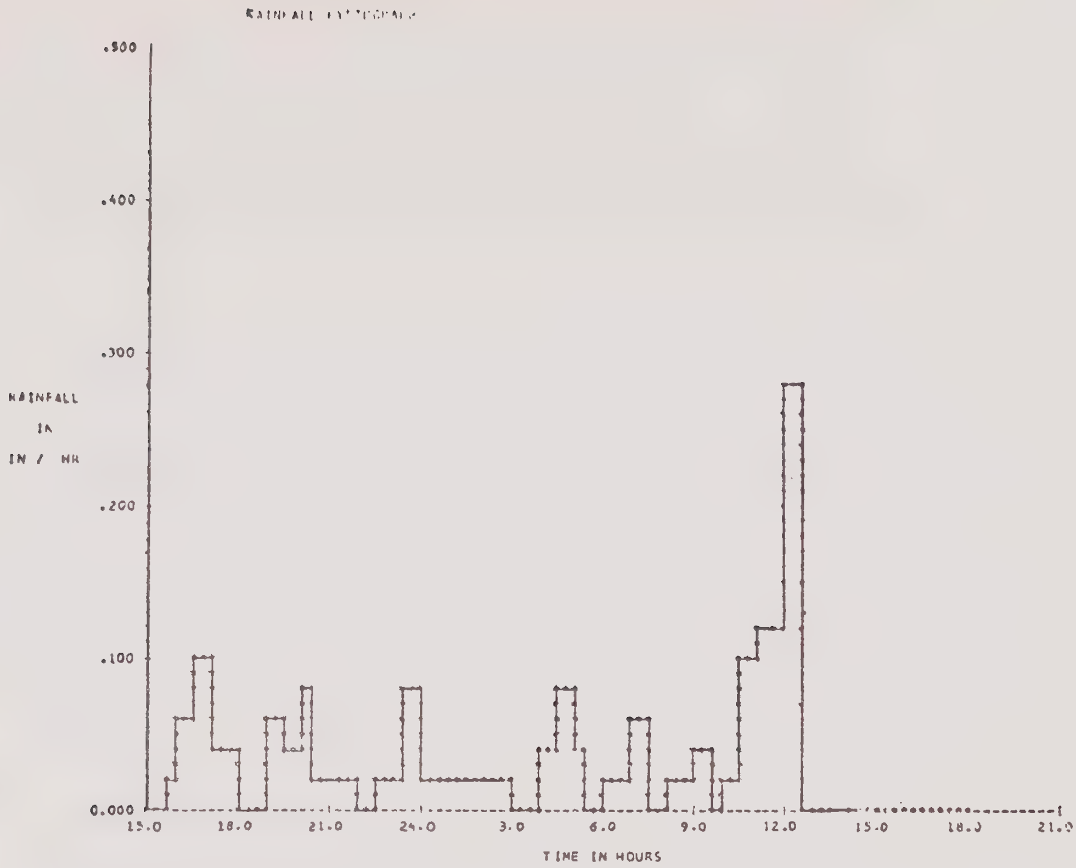


FIGURE C-10
HYETOGRAPH AND OBSERVED VS. SIMULATED HYDROGRAPHS FOR STORM OF DECEMBER 29-30, 1976



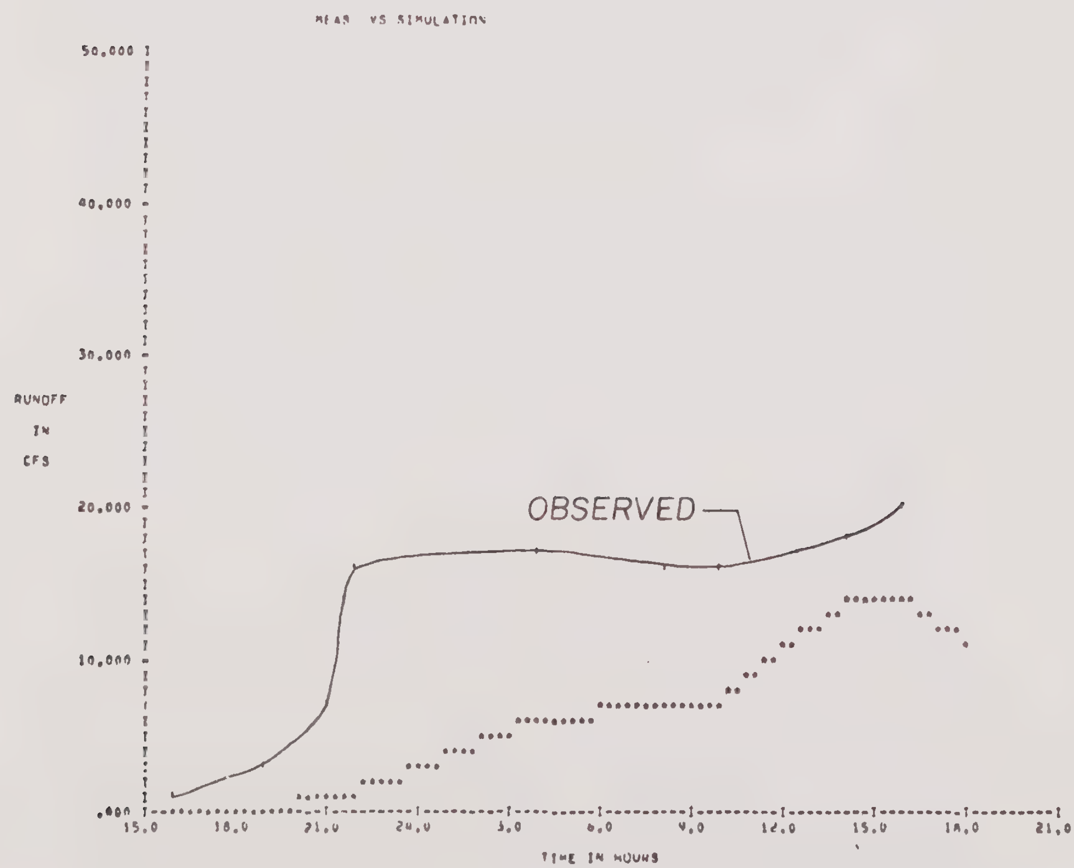


FIGURE C-11
HYETOGRAPH AND OBSERVED VS. SIMULATED HYDROGRAPHS FOR THE STORM OF JANUARY 1-2, 1977

Appendix D
Development of Control Measures Alternatives

CONTROL MEASURES QUESTIONNAIRE

A questionnaire was sent to the members of the Technîcal Advisory Committee seeking information about current practices in a number of areas which were related to possible control measures, such as street sweeping, sewer maintenance, litter control, chemical use, and erosion control. The information served to identify those areas in which the county agencies were already active and those which could use further improvement. The results of this questionnaire were used to eliminate some candidate measures from further consideration and to establish the current practice base upon which some control measures could expand.

REVIEW OF CANDIDATE MEASURES

A list of candidate control measures were prepared for ABAG by Woodward-Clyde Consultants and is included here as Table D-1. At an early stage in the development of control measure alternatives this list was reviewed for the TAC. The following discussion was written at that time:

MEASURES TO REDUCE ACCUMULATION OF POLLUTANTS PRIOR TO RUNOFF

Several of these measures involve removal of solids from street surfaces. They include street cleaning frequency and methods for improving cleaning efficiency (vacuum units, street repairs, parking restrictions). Of course, these measures are only applicable to urban areas and only effective on pollutants that accumulate on street surfaces prior to storm events. No definitive studies on the effects of street cleaning have been performed, but there are studies which indicate that solids accumulate rapidly to a maximum level. This would imply that unless cleanings are very frequent, they may have a smaller effect than expected from removal efficiency studies. Also, it is known that the finer particles are the major contributors of BOD and other pollutants and that these particles are the least likely to be removed.

Other measures that fall into this category deal with the control of certain harmful substances, such as pesticides, fertilizers, soil, animal droppings, and other wastes. The controls may be on the use of the substance or on its proper dumping and disposal. Public education

TABLE D-1
CANDIDATE CONTROL MEASURES

Group A - Measures to reduce accumulation of pollutants prior to runoff.

These control measures are primarily designed for the reduction of pollutant accumulation in streets, storm drains, channels, etc. prior to the occurrence of storm.

1. Provide more frequent street cleaning
   Increase in the frequency of street cleaning in densely populated or commercial areas.
2. Provide more efficent methods of street cleaning
   Use of more efficent street cleaning devices or methods to reduce the amount of solid particles in the street.
3. Repair streets
   Repair of streets in order to increase street cleaning efficency and to reduce the accumulation of pollutants.
4. Control certain chemicals
   Control use of certain chemicals which are known sources of pollutants. Such products include lawn fertilizers, pesticides, and other toxic chemicals used by householders.
5. Restrict auto parking
   Restriction of auto parking in order to increase street sweeping effectiveness.
6. Control use of lots and streets
   Reduction in the type of activities such as painting and car washing, auto repair and maintenance.
7. Control dumping
   Control of dumping of residential, commercial, and industrial wastes on lots and streets.
8. Control littering and dog droppings
   Control littering and dog droppings on streets and gutters.
9. Control automobile and other emissions
   Control of emission from mobile and stationary air pollution sources, in order to lessen the amount of fallout which contribute to runoff pollutants. (This control measure will be considered by ABAG and not by the local agencies.)
10. Control direct discharge of pollutants
    Control of direct discharge to storm water collection systems of pollutants such as paint, motor oil, pesticides, chemicals, and other hazardous liquid and solid wastes.
11. Clean storm water collection system
    Periodic flushing and cleaning of storm drains and removal of debris from channels, pipes, inlets to prevent accumulation of solids in the collection system, perhaps keyed to prediction of rain.
12. Replace cross connections of sewerage systems
    Separation of any cross connections between the storm sewer system and sanitary sewer system.
13. Insure proper operation of septic tanks and leach fields.
    Proper construction and maintenance of septic tanks and leach fields to prevent surfacing sentic tank effluents, which would increase the BOD and bacteria loading of surface runoff.

TABLE D-1 - CONTINUED

Group B - Measures to control land use

These control measures are primarily land use requirements which would modify the amount of pollutants and runoff generated from developed areas.

1. Develop slope density standards
   Establishment of slope density standards which would limit the development of hillside areas thereby reducing the amount of sediments and runoff.
2. Maintain open space areas
   Concentration of urban development to minimize the impervious land surface which will increase the quantity of runoff.
3. Control development patterns
   Control of certain types of land use which are known to cause high amount of pollutants or runoff in environmentally sensitive areas. For example, restriction of development in flood plain or near stream channels and lakes in order to prevent large amount of pollutants from being transported directly into the waterway.
4. Develop buffer strip requirements
   Development of buffer strip such as grass lands or undeveloped open space surrounding new developments in order to reduce the amount of runoff by infiltrating or retarding storm water.

Group C - Measures to reduce amount of pollutants and the peak flow or volume of runoff.

These control measures are primarily designed to reduce the total amount of pollutants and the peak flow or volume of runoff. It should be noted that modification of the peak flow alone may or may not reduce the amount of runoff or pollutants.

1. Control roof drains
   Control of roof drains connected to storm sewers in order to reduce amount of runoff.
2. Construct rooftop detention and storage
   Construction of rooftop detention and storage with appropriate outlet structures in order to delay the runoff thereby reducing the peak of the hydrograph.
3. Rechannel runoff to prevent flow over critical surfaces
   Construction of channels, berms and other control structures to reroute flows around areas that have accumulated pollutants.
4. Redesign curb and gutter configurations
   Redesign of curbs and gutters and streets to either delay or speed up the flow of urban runoff to provide for a more uniform flow in the collection system.
5. Remove debris in channels, pipes, and inlets, to improve flow.
   Removal of large size debris such as construction and demolition debris in order to improve flow conditions in the collection system thereby reducing overflow; flooding and erosion.

6. Regrade disturbed areas

Regrading or terracing of areas that have been modified by construction related events or by natural erosion, in order to reduce the amount of sediment carried off by runoff.

7. Reseed or apply vegetative cover to bare slopes

Reseeding or applying vegetative cover to bare slopes to prevent loss of top soil thereby reducing the amount of sediments carried off by runoff.

8. Stabilize channels of rivers and streams

Stabilizing channels of rivers and streams to prevent soil loss in the storm channel through erosion and undercutting.

9. Control erosion at construction sites

Control of erosion at construction sites by checkdams, berms, straw bales, mulch and road maintenance in order to reduce or prevent runoff from reaching major drainage channels by entrapping sediment that has been carried off the construction site.

10. Regulate construction schedules to avoid concentration of activities in time or space.

Regulation of construction schedules to insure that runoff might be minimized either by staging or by scheduling projects with a consideration of runoff impacts.

11. Construct permanent berms for critical sources

Construction of permanent berms for critical sources such as gas stations, garages, and feedlots to prevent runoff carrying critical constituents (metals, hydrocarbons, oil and greases) from reaching the stormwater collection system.

12. Use energy dissipators to reduce potential for erosion or transport of solids.

Construction of dissipators in stream channels to reduce sediment load and prevent channel erosion.

13. Increase perviousness of surfaces

Increase of pervious surfaces through construction of Dutch drains or porous asphalt paving in flat areas to allow water to infiltrate into the ground in order to reduce runoff.

14. Require minimum amount of pervious surfaces for new construction.

Requiring new construction projects to maintain a certain percent of the land to be pervious.

15. Use efficent tillage and plowing practices for agricultural areas.

Use of efficent tillage and plowing practices for agricultural areas to minimize areas disturbed thereby reducing runoff and soil erosion.

16. Modify drainage basin

Modification of land drainage to reduce the flow and to change the routing of runoff.

TABLE D-1 - CONTINUED

Group D - Measures to treat and store runoff

These measures are primarily designed to treat runoff directly or store flows for later treatment. They are mostly high capital intensive structural solutions. It should be emphasized that these measures will only be considered at a reconnaissance level in preparing the county surface runoff management plan. Reconnaissance level means that the investigation would be limited to the following:

- o A brief description of the control measure including the type of proposed facilities and treatment process and the capacity and method of operation of the facilities.
- o A map of the county showing the location of major proposed facilities.
- o An estimation of capital and operation and maintenance costs based on cost curves provided by ABAG.

1. Trap sediment and solids by use of catch basins

   Construction of large catch basins to trap sediments carried by the storm water.

2. Impound runoff in upstream channels

   Upstream impoundment of runoff to modify the peak flow.

3. Construct on-line or off-line storage

   Construction of aboveground or underground storage facilities including ponds and tanks and oversized interceptors to which the storm water flow can be diverted and released after the peak storm flow.

4. Use existing capacity of storm sewers f[illegible] torage of flows.

   Use existing capcity of storm sewers for storage of flow. It may require use of remote sensing and computer-directed control systems that provide centralized control of regulator and pumping stations on trunk and interceptor sewers to optimize storage.

5. Construct treatment facilities

   Construction of treatment unit processes such as screening, floatables removal, filtration disinfection, nutrient removal, swirl concentrators, biological systems, and physical-chemical systems depending on the type and amount of pollutants to be removed. Such unit processes can be added to the existing facilities or constructed as new facilities for storm water.

6. Use capacity at existing treatment plants

   Use of available capacity at existing treatment plants to remove pollutants from storm water. Such a measure would require flow equalization and storage.

7. Prevent direct discharge of storm water into receiving waters.

   Prevention of direct discharge of storm water into receiving waters by routing of treated or untreated storm waters to artificial lakes, or irrigation ponds.

programs are often mentioned in lieu of outright bans on sales and use. Where the presence of a particularly harmful substance is noted, controls such as these may be the most specific and effective method of solution.

A final type of control measure in this group has to do with cleaning of the drainage system, separating combined systems, and insuring the proper operation of septic tanks. The cleaning of drainage systems, while it may improve conveyance capacity, would only remove pollutants that have accumulated in the system, which may be small compared to other sources. Separation of combined systems is an extremely costly-structural solution. In septic tank areas where problems occur, new regulations or enforcement of existing ones can result in the minimization of surface water contamination.

MEASURES TO CONTROL LAND USE

These measures include such slope density standards, buffer strips, control of development patterns and maintenance of open space. They generally rely on natural infiltration to absorb runoff and its pollution load or control erosion potential. Such measures are mainly directed at reducing potential future problems in developing areas. They would take the form of zoning ordinances and establishment of protected areas as has been done already in areas draining to the environmentally sensitive Suisun Marsh.

MEASURES TO REDUCE AMOUNT OF POLLUTANTS AND THE PEAK FLOW OR VOLUME OF RUNOFF

Measures to reduce the peak or volume of runoff include control of roof drain connections, rooftop detention, modifications, and improvements in the flow conveyance system, and increasing perviousness of surfaces. They are thus largely applicable to urban areas. While these measures may indeed be effective in controlling runoff, the effects on runoff quality are uncertain and depend on the nature of the watershed and the storm event among other things. Redistributing the flow in time may have little effect on the total pollutant load if the flow passes over the same surfaces eventually. Routing flows from roofs or other surfaces to pervious surfaces to increase infiltration can help only if the water that is infiltrated would have added significantly to the pollution load. If the street surfaces contain most of the pollutants, as is thought to be the case, infiltrating roof runoff may be of limited value from a runoff quality standpoint. Insofar as reducing the volume of flow in the street is concerned, the effect may be small unless

the reduction is very large, since it is believed that most of the solids are washed away by the initial flows. These measures take the form of small structural modifications.

Several of the measures in this group deal with the reduction of soil erosion in open or agricultural areas or in developing urban areas. They include construction site controls, land regrading and reseeding, efficient agricultural and grazing practices, bank stabilization or construction of dissipators in eroding channels, and rechanneling of runoff around critical areas. These measures may be very effective in reducing the sediment load in runoff, which is linked to pollutant content. There is also a great deal known about how these controls should be carried out and how effective they are in practice. They are most applicable to open and developing areas and take the form of construction code and other forms of regulations, public education, and channel maintenance programs.

MEASURES TO TREAT AND STORE RUNOFF

These measures are highly capital intensive and can be extremely effective solutions for most storm runoff problems. This does not imply that they are necessarily efficient or cost-effective measures. They involve the use of line or off-line storage (large catchbasins, reservoirs, ponds, underground tanks, existing sewers) or storage plus treatment (existing or special stormwater facilities). These control measures, because of their cost and potential side effects, require a great deal of study and justification prior to being recommended. ABAG has recommended that such measures not be included in the Surface Runoff Management Plan at this time.

From this discussion came comments that led to the development of the surface runoff plan.

PRELIMINARY ASSESSMENT

A preliminary assessment of the candidate control measures accompanied the initial review mentioned above:

Based on the existing and potential surface runoff related problems, the most appropriate control measures for Solano County include those which address:

- ° agricultural operations resulting in erosion and water quality degradation by pesticides
- ° low density residential areas on septic tanks
- ° construction activities
- ° urban runoff

Referring to Table D-2, the measures which address the above sources of water quality problems are:

1. Reduction of pollutant loads in urban areas prior to runoff
2. Control of harmful substances
3. Septic tank controls
4. Reduction of soil erosion

Detailed descriptions of control measures for Solano County to be included in the Surface Runoff Management Plan will have undergone more detailed evaluations and review by County representatives. These evaluations and reviews will occur later in the planning process.

TABLE D-2

PRELIMINARY ASSESSMENT OF CONTROL MEASURES

CONTROL MEASURE	APPLICABILITY ° Area ° Pollutant Type	POSSIBLE ACTIONS	DIRECT DOLLAR COSTS	INDIRECT COSTS	POTENTIAL EFFECTIVENESS
A. Reduce Accumulation of Pollutants Prior to Runoff					
1. Removed from street surfaces	° urban ° primarily suspended solids others to a lesser degree	° improved cleaning methods ° equipment purchases ° bans on parking	low to significant	low	significant, but uncertain
2. Control of harmful substances	° urban and rural ° specific pollutant(s)	° bans on manufacture, sale, or use ° restrictions on use or dumping ° education	low	significant to very high	very high
3. Cleaning of drainage systems	° urban ° all	° maintenance programs	significant	low	low
4. Septic tank controls	° septic tank areas ° organic wastes, bacteria	° requirement on new installations ° inspections of existing units	low	low	very high
B. Control Land Use	° developing or sensitive urban and rural areas ° all	° zoning ordinances ° protected areas ° guidelines for new developments	low	significant to very high	significant to very high
C. Reduce Amount and Peak Flow or Volume of Runoff					
1. Reduce runoff peaks or volumes	° urban areas ° all	° roof detention and drain connections ° conveyance system improvements ° increase perviousness of surfaces	significant to very high	significant	low, but uncertain
2. Reduce soil erosion	° rural, agricultural and developing (construction) areas	° education ° guidelines and regulations on construction and agriculture ° channel maintenance	low to significant	low	significant to very high
D. Store and Treat Runoff	° urban and rural ° all	° storage in ponds, reservoirs, tanks, sewers, catchbasins ° treatment in existing or new high capacity plants	very high	significant to very high	very high

Appendix E
Assessment of Selected Control Measures

IMPROVE STREET CLEANING PRACTICES

General Street Sweeping Impacts

Environmental

- Air Quality
  Street sweeping operations are estimated to remove approximately 10 percent of street particles of less than 10 microns, the size of particles that can be blown through the air. This is a small but beneficial impact. Another consideration is that street sweeping operations do cause dust particles to be released into the air as the pass is made. In view of the fact that most sweepers have dust control equipment and the effect is localized and short-lived, the net effect on air quality is still considered positive.

- Physical Resources - Solid Wastes
  Although the program has no effect on the generation of wastes, and collection of wastes is considered beneficial, the program does produce a supply of materials to be disposed of. This can lead to a reduction in the capacity of disposal sites and the need to find alternative sites. However, the quantity of solid wastes swept off the streets is small relative to other sources of wastes and presents no particular threat to disposal sites.

- Energy
  Gasoline is required for the operation of street sweepers. This use is considered minor.

- Amenities - Visual
  Street sweeping is generally done primarily to improve the appearance of city streets. The impact of this measure is beneficial in this sense.

- Amenities - Noise
  Street sweepers typically create noise levels 70 to 82 dBA at 50 feet during normal operation. This can be a temporary annoyance to people on and adjacent to streets being swept. The timing of sweeping operations has significant influence on level of disturbances.

Economic

° Production of Goods and Services - Employment
Street sweeping programs contribute, in part, to the employment of public works personnel in all cities with programs. Changes in the program would have to be rather substantial to affect employment opportunities.

Social

° Health and Safety - Site Hazards
The removal of debris from streets has a beneficial impact in reducing the risk of accidents associated with this debris, including pedestrian and bicyclist mishaps.

° Physical Mobility - Private Transportation
Operation of slow-moving sweepers can cause minor localized traffic congestion or inconvenience to drivers.

Fiscal

° Property Tax Rate and Other Charges
The costs of acquiring and maintaining street sweepers and other cleaning and support equipment and the operational costs of carrying out cleaning programs must be offset by increased revenues for the maintenance agency. Taxes could be increased to generate revenues to cover increased street cleaning activities. Alternatively, a service charge tied to a utility type of service (such as a sewer system) could be implemented.

Institutional

° Public Acceptance
Generally, the public should accept street cleaning. However, if parking restrictions are imposed in residential areas to increase the efficiency of sweeping, there may be localized resistance particularly where off-street parking is not adequate.

<u>Conduct a Street Sweeping Demonstration Project</u>

Environmental

The project would have the same impacts as present street sweeping programs do, except that they would be increased somewhat in the demonstration areas for a short period of time.

Economic

The demonstration project would not be expected to affect employment in public works departments, but would provide some opportunities for private consulting firms.

Social

Same as present sweeping program impacts, except greater in the affected areas.

Fiscal

The project would have marginal local fiscal effects. The project qualifies for federal funding.

Institutional

Same as present sweeping program impacts.

Prohibit Flushing of Materials from Impervious Surfaces

Environmental

- Air Quality
  Flushing tends to remove fine dust particles more completely than mechanical sweeping, so the prohibition of flushing will reduce air quality in this respect. This is seen as a very minor impact.

- Physical Resources - Water Conservation
  Prohibition of flushing will have a significant beneficial impact on water conservation. However, the exact amount of water that would be saved is not known.

- Amenities - Visual
  To the extent that this prohibition discourages people from flushing their driveways and walks, these surfaces may lose some visual attractiveness.

- Amenities - Noise
  To the extent that street flushing might have been used instead of sweeping, noise reductions will not be achieved.

Social

- Health and Safety - Site Hazards
  There would be a slight danger of accidents caused by slipping on wet surfaces that had just been flushed. This problem will be avoided.

- Amenities - Inconvenience
  The extra work required to sweep driveways may be restrictive to some individuals.

Fiscal

- Fines
  A ban on flushing with an attendant penalty structure may produce

a source of revenue for the city. However, it is expected that once people became fully aware of the ordinance, there would be few violations.

Institutional

- Public Acceptance
  If water becomes plentiful and people relax their conservation attitudes, there could be some resistance to a flushing ban. Cleaning sidewalks and driveways with a broom requires more effort and it is not as effective as flushing these surfaces.

- Political and Organizational Feasibility
  Bans on flushing are not envisioned to be major political issues. The side benefit of conserving water should put this proposal in the category of a "good guy project."

CONTROL CHEMICALS

Environmental

- Air Quality
  Proper application of chemicals can have favorable impacts on air quality as well as water quality, by reducing the amount of chemicals allowed to escape into the air.

- Physical Resources - Flora and Fauna
  Control over the application of chemicals can prevent the exposure of other plants and animals to these potentially harmful substances.

- Physical Resources - Agricultural Lands
  Crop yields can be greatly affected by the type and application of chemical fertilizers and pesticides.

Economic

- Production of Goods and Services - Employment
  Habitat identification, review of existing non-target areas, and alternatives investigations could help create employment opportunities in the agencies performing these tasks.

Social

- Health and Safety - Effect on Public Health
  Education of users should help prevent accidents involving the use of chemicals.

Fiscal

- Licenses and Taxes
  The recommended program may require an increase in the budget of the

County Agricultural Commissioner's Office. Revenues to offset these increased costs may be generated by tax increases, possibly on the sale of chemicals.

Institutional

- Public Acceptance
  The public at large should be amenable to a program regulating the control of chemicals. A small segment of the county population may, however, view the program as a threat to the agricultural economy. Agribusiness may be concerned that the program could result in restrictions on certain chemicals leading to decreased crop yields.

CONTROL DIRECT DISCHARGES

Investigate an Oil Recycling Program

It is assumed that the availability of an oil recycling program will not result in a shift from dumping oil in catchbasins to dumping oil in other locations on land (except at recycling centers). Therefore, impacts associated with such dumping are not considered.

Environmental

- Energy
  Energy consumption to recycle the oil will be offset by savings in energy required to process crude oil.

Economic

- Production of Goods and Services - Employment
  A recycling center could produce employment opportunities.

Social

- Amenities - Inconvenience
  Saving spent oil and delivering it to a recycling center will require more effort than draining it into a sewer.

Fiscal

- Taxes
  The costs of establishing and operating an oil recycling program must be offset by increased revenues. Appropriate taxes (e.g. highway user's tax) could be increased to maintain the program.

Initiate a Public Education Program on the Consequences of Direct Dumping of Pollutants into Storm Drains

Economic

- Production of Goods and Services - Employment
  Employment opportunities in various administrative and advertising positions could be created.

Fiscal

- Taxes
  The maintenance of an educational program will require new revenues which could be offset by a tax increase.

IMPROVE SEPTIC TANK CONTROLS

Environmental

Enforcement of criteria should have no additional impacts other than those related directly to improved water quality.

Economic

- Production of Goods and Services - Employment
  Increases in the number of units on septic tanks will require increases in the number of inspectors required.

- Income and Investment
  The enforced criteria could impact the need for capital investments for new and replacement units.

Social

- Housing Supply
  The criteria can affect the availability and costs of homes in areas not served by sewers.

- Urban Patterns
  There would be a possible discouragement of rural home construction in some areas which could impact the eventual urban pattern as development continues.

Fiscal

- Taxes
  Program costs and possibly the need for more inspectors would require additional taxes, which could be placed on home owners with septic tanks.

CONTROL CATCHBASINS

Environmental

° Air Quality - Odor
A catchbasin that is not maintained properly can result in water stagnation. Eutrophication can then occur with its resulting odor. This measure would reduce the number of such occurrences.

° Energy
Reducing the number of catchbasins to be cleaned will have a minor effect on energy consumption by public works operations, but may be offset by increased frequency of cleaning of remaining catchbasins and pipes.

° Amenities - Noise
If the number of catchbasins to be cleaned is reduced, the noise problem associated with catchbasin cleaning will be reduced in areas where vacuum type units are used to clean catchbasins. If increased maintenance is necessary in some locations, the impact will be adverse.

Economic

° Production of Goods and Services - Industrial, Commercial Activity
This measure may create a local increase in demand for precast inlets.

° Production of Goods and Services - Employment
The reduction in number of catchbasins to be cleaned could result in a slightly reduced need for manpower in public works departments. This may be offset by the need to increase the frequency of cleaning of the remaining catchbasins.

Social

° Health and Safety - Effect on Public Health
The reduced number of catchbasins will present fewer areas for the breeding of mosquitos and facilitate their control.

Fiscal

° Minor increased costs expected to implement program with potential savings in costs of catchbasin cleaning in the future.

CONTROL EROSION

Erosion Control for Construction Activities

Environmental

° Air Quality
Proper construction erosion control reduces the amount of wind-blown particles.

° Energy
Some required controls would involve the use of machines which consume fuel.

° Amenities - Visual
Proper grading and vegetation of sites improves their visual appearance.

Economic

° Consumer Expenditures - Prices of Goods and Services
The formulation and implementation of an erosion control plan will increase the cost of new construction. This would probably be a very minor portion of the total cost, however.

Social

° Housing Supply
Additional requirements on erosion control may lead to changes in the location and timing of new housing starts, as well as increases in costs.

° Health and Safety - Site Hazards
Proper erosion control would help insure stable banks and generally safer construction site conditions.

° Urban Patterns
Erosion control requirements could encourage growth in areas with fewer potential erosion problems, altering growth patterns.

Fiscal

° Tax Base
The requirement for erosion control plans may result in improvements which will increase the market value of specific properties. If this occurs, additional revenues may come to the county partially offsetting the increased costs of reviewing construction plans and inspecting the installation of approved erosion control measures.

Institutional

° Public Acceptance
There could be opposition to this requirement if it is viewed as leading to increased construction costs to be passed on to the owner.

<u>Erosion Control for Agricultural Activities</u>

Environmental

° Air Quality
Erosion control practices can reduce wind erosion as well as erosion by water.

° Physical Resources - Agricultural Lands
Erosion control practices can significantly reduce the loss of valuable top soil and have favorable impacts on crop yields over several years. They may also allow the planting of otherwise unsuitable lands.

° Energy
Some of the practices require the use of machinery which consume fuel.

Economic

° Production of Goods and Services - Agricultural Activity
Erosion control can favorably impact crop yields and the amount of land available for planting, increasing productivity.

° Production of Goods and Services - Employment
To an unknown extent, employment on farms may be increased by the implementation of erosion control practices. Job opportunities at the SCS are also affected by the use of their services.

° Income and Investment - Capital Investment
Some control measures would require investments on the part of the farmer to purchase machinery, equipment and supplies. There is federal aid available for such purposes.

° Consumer Expenditures - Prices of Goods and Services
The increased use of erosion control measures may influence crop prices, but there are too many other variables involved to predict the effect.

Fiscal

° Tax Base
The use of erosion control may result in improvements which will increase the market value of specific properties and increase the tax base.

Institutional

° Public Acceptance
There is sometimes a reluctance on the part of the land holder to implement these measures due to the costs involved.

CONTROL LAND USE

<u>Environmental</u>

° Physical Resources - Flora and Fauna
Creekside ordinances will protect natural riparian habitats. Open

space preservation maintains natural habitats for a wide variety of plants and animals and helps maintain adequate environmental conditions in downstream marshes and bays which serve as flyways, nesting, and breeding grounds for several species.

- Physical Resources - Agricultural Lands
  Preservation of agricultural land and control over parcel size and agricultural practices should lead to improvements in the amount and quality of prime agricultural land resources and prevent the conversion of such land to urban use.

- Physical Resources - Recreation Use and Potential
  The maintenance of open space and protection of marshes and creeks will help maintain the quality of existing recreational uses and keep potential sites available for future recreational development.

- Amenities - Visual
  Preservation of scenic open space areas maintain the visual aesthetics of the site. Improved subdivision design can improve the appearance of the urban landscape.

Economic

- Production of Goods and Services - Agricultural Activity
  The examination of parcel sizes and agricultural practices on lands adjacent to Suisun Marsh could lead to impacts on agricultural production.

Social

- Housing Supply - New Housing Stock
  Any increase in the minimum parcel size would reduce the amount of land available for new housing in rural areas. Subdivision design to improve runoff characteristics may include lower density development which may reduce the availability of housing in certain areas.

- Health and Safety - Site Hazards
  Open space preservation, particularly in mountainous areas, reduces the hazards to life and property resulting from fire, landslides, erosion, and seismic activity. Improved subdivision design and creekside ordinances can reduce flood and land subsidence hazards to people and property in these locations.

- Equity - Individual Opportunity and Lifestyle
  The maintenance of open space and agriculture along with urban development allows all individuals wider choice in employment and recreational opportunities and general lifestyle.

- Urban Patterns
  Land use controls will have profound impacts on the location and density of future urban development.

Institutional

- Public Acceptance
  It is likely that certain groups may oppose any land use control decision made. Among the groups which may be involved in the decisions are agricultural interests, business groups, environmentalists, and private citizens directly affected by a measure.

Appendix F
Glossary of Surface Runoff Terms

ABAG	The Association of Bay Area Governments.
Algae	Any of numerous chlorophyll-containing plants of the phylum thallophyta and grow in either sea water or fresh water; seaweeds and pond scum are algae.
Ambient	Completely surrounding or encompassing.
Base Flow	Stream discharge derived from groundwater sources. Sometimes considered to include flows from regulated lakes or reservoirs. Fluctuates much less than storm runoff.
BOD	The abbreviation and most commonly used name for biochemical oxygen demand. This is the quantity of oxygen used in the biochemical oxidation (decay) of organic matter in a specified time and under specified conditions. In general terms, a high BOD suggests a water burdened with organic wastes and thus likely to be deficient in oxygen and inhospitable for most plant and animal life.
Calibration	The procedure of assigning values to the uncertain or unknown parameters in simulation model and adjusting them until model predictions correspond acceptably with observed prototype behavior.
Catch Basin	A chamber or well, usually built at the curb line of a street, for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.
Coliforms	A large and varied group of bacteria. Fecal coliform bacteria, commonly found in the intestines and feces of warm blooded animals (including man), apparently does not cause disease, but its presence in water suggests that disease causing organisms may be present. Coliforms are used as indicators of pollution because they are abundant and their presence is fairly easy to detect.
Computer Modeling	The simulation of certain physical events via a mathematical model. As the calculations involved are usually numerous and lengthy, a computer is used to expedite the process.
Concentration	The quantity of a given constituent in a unit volume or weight of water.

Contamination	The introduction into water of pathogenic organisms that render it unfit for human consumption or domestic purposes.
Control Measure	Any action that will reduce or hold steady the quantity of one or more pollutants being discharged into a receiving body of water.
Dissolved Oxygen	The concentration of dissolved oxygen in water (measured in mg/l). Non-living organic matter and various chemicals react with oxygen in water, depleting its concentration and causing stress (from lack of oxygen) on fish and other aquatic life. DO saturation levels are greater in cold water than in warm, and at sea level (high atmospheric pressure) than at high altitudes (low atmospheric pressure).
Dissolved Solids	The total amount of dissolved material, organic and inorganic, contained in solution in water or wastes.
Drainage Basin	A geographical area or region which is so sloped and contoured that surface runoff from streams and other natural water-courses is carried away in a single drainage system by gravity to a common outlet or outlets; also referred to as a watershed or drainage area.
Dry Weather Flow	The combination of sanitary sewage, and industrial and commercial wastes normally found in the sanitary sewers during the dry weather season of the year. Also, that combination of flow in streams during dry seasons.
Effluent	The liquid discharged by a sewage treatment plant or industry.
EMP	The Environmental Management Plan for the San Francisco Bay Area.
EPA	The Environmental Protection Agency.
Erosion	The washing away of soil by the action of surface runoff.
Eutrophication	The progressive enrichment of surface waters particularly non-flowing bodies of water such as lakes and ponds with dissolved nutrients, such as phosphorous and nitrogen compounds, which accelerate the growth of algae and higher forms of plant life and result in the utilization of the useable oxygen content of the waters at the expense of other aquatic life forms.
Fecal Coliform	Fecal coliform are indicators of human and animal pollution and are expressed as numbers of bacteria per volume of sample.
First Flush	The condition, often occurring in storm sewer discharges and combined sewer overflows, in which a disproportionately high pollution load is carried in the first portion of the discharge or overflow.

Floatables	Litter, debris, oil and grease.
Groundwater	Subsurface water that occupies the pore spaces of the rock in which it is located.
Groundwater Recharge Area	The portion of a land surface through which the groundwater receives its replenishment by the percolation of water through the soil and intermediate zone.
Heavy Metals	Elements in water that can be precipitated by hydrogen sulfide in acid solution, e.g., lead, silver, mercury and copper. Considered as serious pollutants.
Hydrograph	A graph of the flow in a stream during a time period.
Hyetograph	A graph of rainfall intensity versus time during the period of a storm.
Land Use Category	The specific classification of a given piece of land based on its predominant use, e.g., residential, commercial, etc.
Leach Field	A system of open pipes within covered trenches allowing the effluent from a septic tank to enter the surrounding soil.
Loading	The quantity of a specific water quality parameter discharged into a specific body of water over a specific period of time.
Low Flow	The period, during the course of a year, when the flow in a stream is at a minimum. In California, low flow usually occurs in late summer or early fall, at the end of the dry season.
MAC	Abbreviation for the Macroscopic Planning Model. A computer model used in the preparation of the Surface Runoff Management Plan.
Model Run	The process of having the computer perform the model calculations with specific set of input data.
Monitoring	The measurement of water quality.
Nitrate	A form of nitrogen which is an essential nutrient to plants (can cause algal blooms if all other nutrients are present in sufficient quantities). Product of bacteria oxidation of other forms of nitrogen, from the atmosphere during electrical storms and from fertilizer manufacturing.
Nitrogen	Usually ammonium, nitrite, and nitrate ions, and certain simple amines are available for plant growth. A small fraction of organic or total nitrogen in the soil is available at any time.

Nonpoint Source Pollution	A pollutant which enters a water body from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances.
Non-Settleable Solids	That matter in wastewater that will stay in suspension during a preselect settling period.
NPDES	National Pollutant Discharge Elimination System.
Nutrients	Substances essential to biological growth. Those elements which provide food for aquatic plant life. Generally nitrogen and phosphorus.
Organics	Materials composed of carbon, hydrogen and oxygen.
Outfall	The point or location where waste water or drainage discharges from a sewer, drain or other conduit.
Overflow	A pipeline or conduit device together with an outlet pipe that provides for the discharge of portions of combined sewer flows into receiving waters or other points of disposal, after a regulator device has allowed the portion of the flow which can be handled by interceptor sewer lines and pumping and treatment facilities to be carried by and to such water pollution control structures.
PCB	Polychlorinated Biphenyls. Organochlorine compounds of a pesticidal nature which are usually used for industrial purposes (such as plastic manufacture).
Point Source Pollution	"The term 'point source' means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, folling stock, concentrated animal feeding operation vessel or other floating craft, from which pollutants are or may be discharged." (Act, Section 502(14)).
Pollutant	"The term 'pollutant' means dredged spoil, solid waste incincerator residue, sewage, garbage, sewage sludge, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water." (Act, Section 502(6)). Refers to any of several constituents found in water and deemed to be harmful if present in large enough quantities. Referring to something as a pollutant generally refers to its potential and does not necessarily imply an existing problem. (See Pollution and Water Quality Parameter).
Pollutant Loading	An estimation of the amount of a given pollutant washing off a land surface of a given type, usually after a rainfall.

Pollution	The loss or impairment of a beneficial use of a body of water due to a change in the level of one or more water quality parameters.
Pollutograph	A graph of pollutant concentration as a function of time during a rainfall/runoff event.
Primary Treatment	A series of mechanical treatment processes, including screening, skimming and sedimentation, that remove most of the floating and suspended solids found in sewage, but that have a limited effect on colloidal and dissolved material.
Public Law 92-500	The federal law which required the preparation of the EMP. Also known as the Federal Water Pollution Control Act Amendments of 1972.
Receiving Water	A natural watercourse, lake or ocean into which treated or untreated wastewater is discharged.
Recurrence Interval	A term referring to the frequency and intensity of storm. A storm with a 100-year recurrence interval has a 1 percent chance of occurring in any given year.
Residual Wastes	Those solid, liquid, or sludge substances from man's activities in the urban, agricultural, mining and industrial environment which are not discharged to water after collection and necessary treatment.
Retention Storage	The temporary storage of stormwater runoff in a device such as a pond or basin.
Runoff	That portion of the precipitation on a drainage area that is discharged from the area in stream channels.
Runoff Factor	The percentage of rainfall that actually runs off the land and into a drainage system.
Sampling	The physical process of obtaining Sample Sets.
Sample Set	A group of water samples to be analyzed for several water quality parameters.
Secondary Treatment	A series of biochemical (trickling filters or activated sludge), chemical (coagulation), and/or mechanical (sedimentation) treatment processes, that remove, oxidize, or stabilize non-settleable, colloidal and dissolved organic materials found in sewage, following primary treatment.
Sediment	Visible fine organic or earthen particles suspended in water.
Sedimentation	The process of subsidence and deposition of suspended matter carried by water, sewage, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point where it can transport the suspended material.

Silt	Fine particles of soil and rock usually less than 1/20 millimeter in diameter.
SRM	Surface runoff management.
SRMP	The Surface Runoff Management Plan.
Subarea	A watershed of a small stream or creek or a portion thereof; the smallest unit of analysis in water modeling, defined using the criteria of homogeneous slope, homogeneous land use (hydraulic roughness), and uniform width, measured perpendicular to the direction of flow.
Surface Runoff	Rainwater which flows over the land surface and into a drainage system rather than soaking into the ground or evaporating.
Suspended Solids	Particulate matter held in suspension (as opposed to dissolved) in water and readily removable by filtering.
SWMM	The EPA Stormwater Management Model.
TDS	Total Dissolved Solids. The dissolved salt loading in surface and subsurface waters.
Tertiary Treatment	Any sewage purification process that has the capability to remove over 98 percent of the pollutants from sewage, following secondary treatment.
Total Nitrogen	The total amount of the element nitrogen, a principal nutrient required for biological growth, in all its chemical forms. Four forms of nitrogen are of main interest in water quality management. These are ammonia, nitrite, nitrate, and various compounds of organically-bound nitrogen. These forms are all normalized and expressed as total nitrogen.
Total Phosphorus	The total amount of the element phosphorus, a principal nutrient required for biological growth, in all its chemical forms. Phosphorus may exist in wastewater as ortho, poly, and organic phosphorus.
Total Suspended Solids	All particulate matter in a water sample that is removable by laboratory filtering.
"208"	Refers to Section 208 of the Federal Water Pollution Control Act Amendment of 1972 (PL 92-500). Section 208 provides for the designation of areawide waste treatment management planning agencies for the purpose of "developing effective areawide waste treatment management plans" for areas that, because of "urban-industrial concentrations" or other factors, have "substantial water quality control problems." The areawide approach is aimed at integrating controls over municipal and industrial wastewater, storm sewer runoff, non-point source pollutants and land use.

Water Quality Parameter	A general term referring to any one of the many properties or constituents of a body of water that are commonly measured as indicators of the quality of the water, e.g., temperature, dissolved oxygen, BOD, suspended solids.
Watershed	A region or area bounded peripherally by a drainage divide and draining ultimately to a particular watercourse or body of water.
Wet Weather Flow	A combination of dry weather flows, infiltration, and inflow which occurs in sewers as a result of rainstorms.

170

Surface Runoff Management Plan

for the

Petaluma River and Sonoma Creek

Watershed Basins

of

Sonoma County

including the cities of

Petaluma and Sonoma

Prepared by:
Sonoma County Water Agency

October, 1977

The preparation of this report was financed in part through an areawide waste treatment management planning grant from the Environmental Protection Agency, Region IX, under the provisions of Section 208 of the Federal Water Pollution Control Act as amended.

SONOMA COUNTY WATER AGENCY
(Formerly Sonoma County Flood Control & Water Conservation District)
SONOMA COUNTY ADMINISTRATION BLDG. SANTA ROSA, CALIFORNIA 95401
PHONE (707) 527-2211
GORDON W. MILLER
Chief Engineer

Dear Plan Recipient:

The Final Draft of the Surface Runoff Management Plan is transmitted herewith. This plan represents the general concensus of the local agencies and the general public as to what should be done about surface water pollution. The plan includes supporting descriptive and technical data.

The public should review it for conformance with their desires as to the level of effectiveness of control of surface water pollution. Reduced surface water pollution means cleaner water and fewer problems created by polluted water.

The local agencies should review it for conformance with their capability and desire to implement the plan in a general sense. It should be understood that this plan along with the seven other Bay Area county plans will be integrated into a regional environmental management plan by the Association of Bay Area Governments as required by the U. S. Environmental Protection Agency. That integrated regional plan will be submitted to the individual counties for adoption during the last weeks of December 1977. During the interim, the local agencies should modify, supplement or delete from this plan as necessary to satisfy their concerns.

During the next few weeks the Water Agency staff will be meeting with ABAG and other county staff to work on regional plan integration. We invite continued input to guide us in achieving a regional plan which is acceptable to the County of Sonoma and the Cities of Petaluma and Sonoma and also to the general public of that part of Sonoma County affected by this plan.

Respectfully submitted,

Bill Stillman
Win Smith
Rod Schuler

CONTENTS

CONTENTS - continued

APPENDIX

CONTENTS - continued

I SUMMARY

The Surface Runoff Management Plan (SRMP) is one of six elements of the Environmental Management Plan being developed by ABAG for the San Francisco Bay Region. The Surface Runoff Management Plan is a locally prepared plan designed to meet the Federal clean water mandate under Public Law 92-500, Section 208, by 1983.

The Federal Government has instructed local government to restore or maintain the quality of surface runoff reaching receiving waters; however, it has been very difficult to identify and assess the magnitude of suspected runoff problems. As a result, county lead agencies have shown a degree of caution and uncertainty in the individual draft Surface Runoff Management Plans. The SRMP has been phased into an initial planning period and a continuing planning period to separate identifiable issues from uncertain issues.

The first phase (1978-1980), the initial planning period, proposes establishment of authority for plan implementation, intensified street sweeping, review and development of new ordinances, documentation of new problems and initiation of educational programs.

The second phase (1980-1983), the continuing planning process, deals with solution of possible future problems if and when they have been proven to be significant.

The County Surface Runoff Management Plan, will be administered by a Surface Runoff Quality Committee (SRQC) staffed by a County lead agency. The SRQC will direct the implemention of the SRMP and will coordinate monitoring activities with the San Francisco Regional Water Quality Control Board.

II INTRODUCTION

Preface

The United States Congress provided for local participation in the planning program to achieve compliance with Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). This plan is an element of participation in that program.

Goals

The general goal is to attain the maximum possible improvement in water quality within economic resources and environmental constraints of the community and comply as fully as possible with the requirements of Section 208 of the Water Pollution Control Act Amendments of 1972. The chemical, physical and biological integrity of the Nation's water is to be restored and maintained with a 1983 Section 208 interim goal that wherever attainable, water quality should provide for the protection and propagation of fish, shellfish, and wildlife and for recreation in and on the water.

Objectives

1. Provide the maximum opportunity for the general public to participate in formulation of the plan.

2. Formulate a plan for near term and long term control measures necessary to mitigate existing and future surface water pollution problems.

3. Adopt institutional, financial and legislative policies necessary to implement control measures.

4. Integrate the local plan into the Association of Bay Area Government's (ABAG) Environmental Management Plan.

Planning Area

The planning area includes the cities of Petaluma and Sonoma and that portion of the unincorporated area of Sonoma County which drains to San Pablo/San Francisco Bay. The Petaluma River (drainage area 142 square miles) and Sonoma Creek (drainage area 175 square miles) are the major waterways, each draining directly to San Pablo Bay. San Antonio Creek is a major tributary of the Petaluma River which delineates the boundary of Marin County and Sonoma County. Part of the San Antonio Creek watershed lies in each county requiring future cooperative effort on necessary control measures.

Purpose

The purpose of this plan is to locally develop solutions to surface runoff pollution problems and to express the commitment of the local agencies toward implementation of pollution control measures.

Intra-County Plan Review

A citizens' advisory committee and a technical advisory committee were formed and have met frequently throughout the development of this plan. In addition, two citizens workshops were conducted by ABAG in Sonoma County. The cities of Petaluma and Sonoma and the County of Sonoma will review and approve the plan.

Regional Plan Review

The Sonoma County Surface Runoff Management Plan is intended to be integrated into an Environmental Management Plan (EMP) by ABAG. The integrated plan will be submitted to the local agencies for endorsement prior to adoption by the ABAG General Assembly. The EMP will then be submitted to the State for future State and Federal approval.

Implementation

The County of Sonoma is not a member of the Association of Bay Area Governments. This presents some uncertainty as to the commitment of Sonoma County to implementation of the plan in the unincorporated areas. This report has been written assuming that Sonoma County will adopt the plan and will participate in implementation of the plan.

III PLAN DESCRIPTION

What is the Plan?

The plan includes identification of surface water problems, investigation of suspected problems, development of control measures and specification of implementation methods.

Which problems are being dealt with?

All surface runoff problems are considered excluding only those point source discharges which will be regulated under Section 201 of water pollution control legislation.

What are the costs?

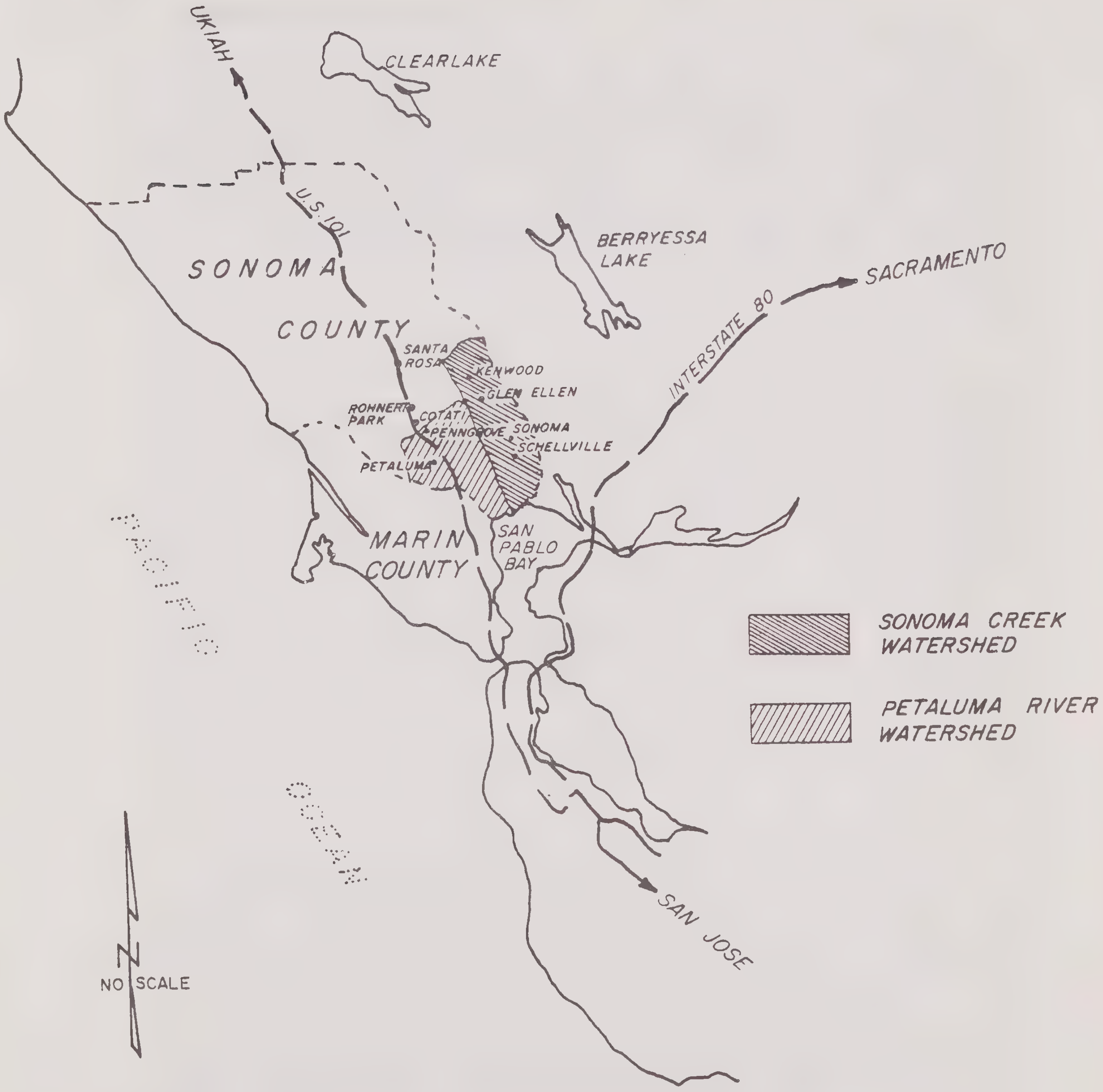
The costs will vary from no cost for certain alternates in the initial planning period to substantial cost for mechanical or structural control measures during the continuing planning period. Many solutions can be obtained by better management practices using existing capability. This is referred to as implementation of best management practice (BMP). Other measures such as mechanical and structural control can be very costly and should only be implemented if the problem solved justifies the expense. Cost information is found in the conclusions section and in the plan summary.

Who will pay?

In general, solutions to local problems will be funded locally. Regional problems should be funded through State or Federal sources with local cooperation.

Who is doing what?

This plan was written by the Sonoma County Water Agency under a contract with the Association of Bay Area Governments (ABAG). ABAG is the lead agency under contract with the State Office of Planning and Research to produce an Environmental Management Plan (EMP) for the San Francisco Bay Area. This plan is the Sonoma County contribution to the Surface Runoff element of the EMP. The EMP including Surface Runoff element will be reviewed by California Water Resources Control Board and submitted to the U. S. Environmental Protection Agency (EPA) for final approval. The local agencies are expected to implement the Surface Runoff Plan.



LOCATION MAP

IV CONCLUSIONS

Plan Necessity

The Federal Government through EPA requires that a plan be prepared, adopted, and implemented.

It is without doubt that man's impact on the land and the waste products from his activities affect the environment. It is also without doubt that surface runoff has the potential for conveying silt and pollutants. The magnitude of the effects of these water borne constituents should be known so that ongoing and future activities can be properly regulated to mitigate adverse impacts on water quality. A plan is an indispensable step toward beginning to identify the problems and specifying control measures. Notwithstanding the Federal mandate, there should be a surface runoff plan.

Problem Identification

Except for the excess sediment which has been deposited in the tidal areas of Sonoma Creek and the Petaluma River, there is a lack of conclusive evidence at this time that there is a significant pollution problem in Sonoma County attributable to non-point source surface runoff. There are suspected problems but there are conflicting opinions as to the magnitude and there is insufficient research data available at this time to identify with certainty the relationship of those suspected problems with pollutants in surface water. Special studies by other agencies and other available information indicates that surface runoff constituents may affect flora and fauna of streams, bays and tidal areas but that the true magnitude of these suspected problems cannot presently be specified with certainty. There are many ambiguities and unknowns associated with identification of surface runoff pollution problems. Some of the points of concern about problem identification are as follows:

Lack of substantiation that the receiving water is actually adversely impacted, except for the known sedimentation problem.

Lack of water quality criteria for the receiving water.

Lack of control base to indicate what level of control is adequate.

Lack of knowledge as to the capacity of the receiving water to assimilate water borne pollution constituents.

Lack of natural surface water runoff baseline quality information.

Because of these unknowns, it is not possible to specify the required level of effort needed to control suspected pollution sources to achieve a desired level of effectiveness toward mitigation of suspected pollution problems.

On the basis that some of these problems will be found to be significant in the future, this plan presents procedures to work toward mitigation through control or reduction of pollutants.

Future problems may develop as a result of continued land development, growth of communities, and related impacts of increased human use of the environment. At such time as problems can be reliably predicted, the appropriate recommended control measures should be implemented.

Implementation-Initial Phase

Implementation will be dependent upon local funding. Without funding there can be no Surface Runoff Management Plan. An estimated $154,100 will be necessary for implementing the initial 1978-80 two year planning period. Of the 26 proposed actions, two are cost intensive and account for over $100,000--$60,000 for a 208 coordinator and supporting staff and $44,600 for initiation of a presently non-existent County street sweeping program. Considering program financing, one method for raising this sum would be to institute a County property tax rate increase of $.008/$100.00 assessed valuation including the incorporated areas. This financing program would assume Countywide Surface Runoff Management Plan implementation with a County department as 208 lead agency. Another financing mechanism would be the initiation of a $.008/$100.00 assessed valuation district-wide Sonoma County Water Agency (SCWA) tax.

At this point in time, it would be highly speculative in the absence of a completed 208 study for the remainder of the County to assume Countywide program coordination. A more equitable financing plan would be based on tax rate increases in the existing SCWA flood control zones No. 2A (Petaluma) and 3A (Sonoma). Increases would be $.03/$100.00 assessed valuation in Zone 2A and $.04/$100.00 assessed valuation in Zone 3A. This method of financing would assume the Water Agency to be the 208 coordinating agency.

The critical step toward plan implementation will be formation of the Surface Runoff Quality Committee (SRQC) with a supporting lead agency to provide support. The SRQC will establish, guide and monitor the actual implementation steps taken. Beyond that, concern and dedication of each community's elected and staff officials will determine the effectiveness of implementation. Another implementation factor will be the incentives or sanctions employed by EPA to obtain local agency implementation.

Continuing Planning Process

In June of 1978, if the need is demonstrated, a work program will be developed for the first year of the continuing planning process, fiscal year 1978-79. At that time, appropriate control measures would be selected and their costs identified for the first year activities. In preparing the surface runoff plan, continuing planning process (1980-83) control measure priorities were not established nor were costs identified as the need for specific recommendations has yet to be identified. The SRQC, working with other agencies having environmental management responsibilities, will make those decisions at the appropriate time. It is envisioned that the continuing planning process will carry through the year of 1983. It is entirely possible, however, that the need for continuing the program could end prior to the 1983 deadline.

Implementation of pollution control measures at the local level has been, on the whole, far below the needed level when only local funding is used. Grants of Federal funds covering most of the cost were necessary to entice

local agencies to construct or reconstruct point source sewage treatment facilities (201 Program) even though the need was often visible and obvious.

The suspected non-point source pollution problems and sources will need to be more positively identified before local agencies and individuals will see the need to commit funds toward control or reduction of suspected pollutants. Inevitably, these points are raised by the public and local agencies. "Show us that there is a real problem". "Show us that the suspected pollution source is in our jurisdiction". "Show us that proposed control measures will be effective and that the benefit justifies the cost".

As southern Sonoma County has only one easily identifiable pollution problem from non-point source surface runoff, which is sedimentation, there is concern expressed by city officials, both elected and staff, and individuals such as owners of farms, businesses, and industry that significant expense toward control of other suspected pollutants is not justifiable. However, most agree that there may be real problems among the suspected problems and that as a minimum effort best management practice at reasonable cost would be desirable at this time.

Plan Acceptance

Acceptance of this plan by the cities of Petaluma and Sonoma and the County of Sonoma implies intent as to the actions specified and intent to secure such funds as necessary to accomplish local agency commitments. Funding of the initial phase of the plan may be from local property tax revenues and/or State and Federal grants. It is anticipated that a Federally mandated program such as this will also bring with it grants to assuage any unusual drain on local agency funding capability.

Local endorsement of the integrated EMP will be requested by ABAG about January 1, 1978.

V THE PLAN

General

This plan identifies the issues regarding surface runoff pollution and provides a framework for implementation of short term actions which the agencies will take to discharge their responsibility. In addition, an outline of possible future long term strategies is presented for implementation when problem identification provides positive answers and when mitigations can be shown to be effective. The Plan Summary Tables outline these proposed actions and are the basic elements of this plan.

Discussion of the issued related to the plan are contained in the following pages. Further information relative to time frame of these action items is provided in the Initial Phasing Implementation Schedule and the Sequence of Activities tables. Additional supporting detail and scientific data are contained in the Appendix.

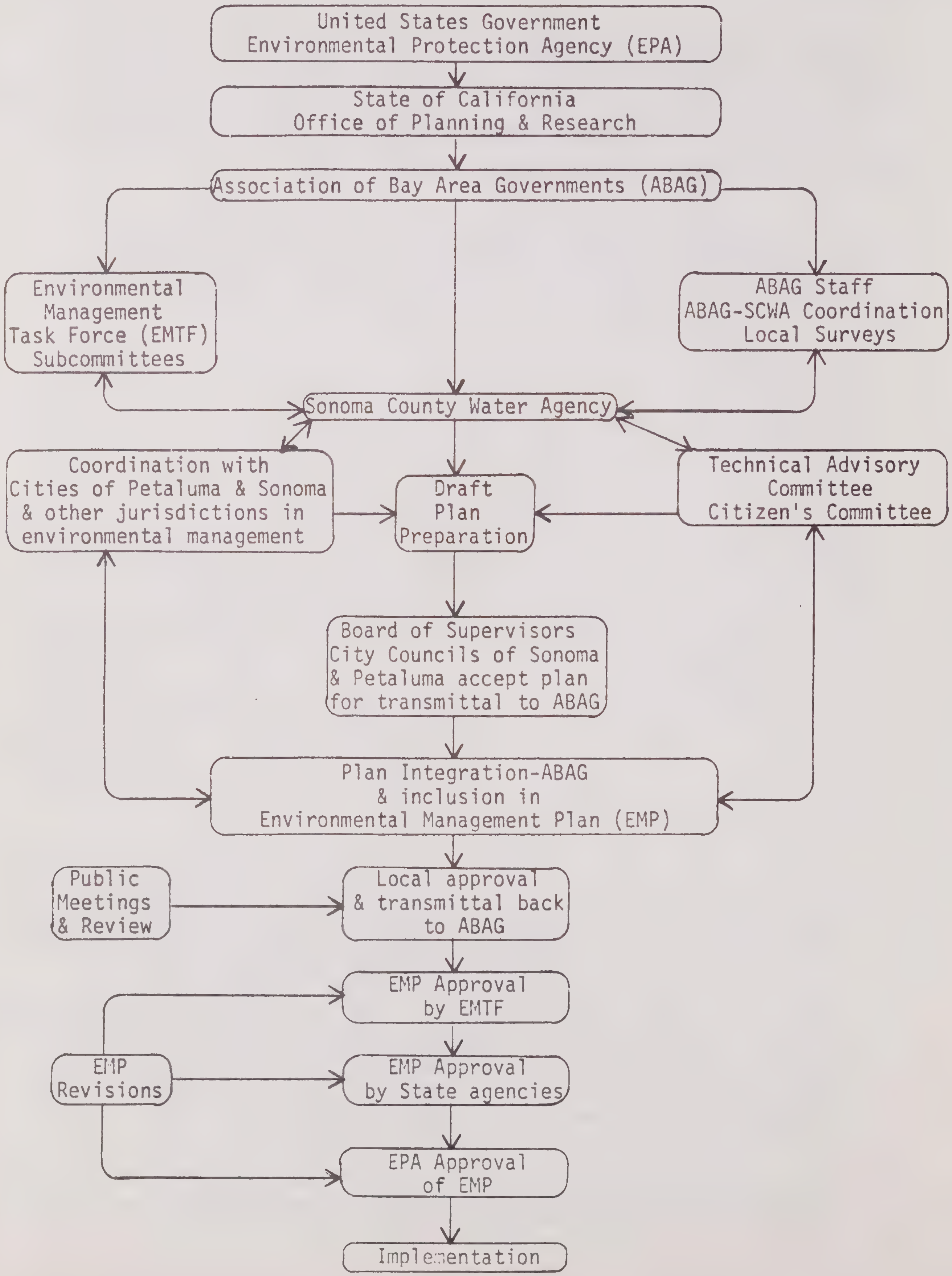
Plan Methodology

The Surface Runoff Management Plan was for the most part locally executed. The Sonoma County Water Agency staff, in working with a citizens' committee, a technical advisory committee, and with governmental entities having environmental responsibilities, designed the County's SRMP with the assistance of ABAG staff and guidelines. During the course of the study, these groups were consulted on numerous occasions as to problem definition, problem mitigation and plan strategies. In the early stages of plan formulation, the citizen committee was utilized to suggest control measures for suspected surface runoff problems. As the study progressed, it became apparent that some of the "problems" mentioned regionally at citizen committee meetings and at ABAG roundtable sessions were in fact not real problems, but suspected problems. As a result, the philosophy for action strategies was changed. The costly structural solutions to improve the quality of non-point surface runoff were, through this public assessment process, revised to reflect public sentiment. A more cautious and relatively low cost set of "best management practices" was selected for implementation until more is understood about the extent of water quality problems resulting from non-point sources.

The activities of plan development were closely coordinated with ABAG and the other seven counties preparing similar plans. This coordination effort expedited the plan preparation process as the counties collectively shared experiences and assisted each other at county lead agency workshops which were held monthly at ABAG. At one point in the study, the county lead agency staffs met independently to discuss program progress and problems which they had encountered in dealing with the ABAG staff. There was a common feeling that ABAG was "spoon feeding" the counties and that the counties were losing control of plan development. The concensus of the meeting was that the counties should co-chair future meetings with ABAG staff and assist in agenda preparation for future meetings. The subsequent co-chaired meetings ran smoothly and the encounter with ABAG resulted in much improved inter-county/ABAG relations.

The County's first draft plan was reviewed at public meetings by the City Councils of Sonoma and Petaluma, the County Board of Supervisors, and the

PLAN DEVELOPMENT RELATIONSHIPS



Citizens' Advisory Committee. Additionally, agencies and jurisdictions having environmental management tasks were given the opportunity to submit their comments prior to releasing the final draft plan.

The City Councils of Sonoma and Petaluma as well as the County Board of Supervisors have received the plan favorably and have authorized its transmittal in final draft form to ABAG for inclusion in the Environmental Management Plan.

The Surface Runoff Management Plan will be a locally implemented program with the understanding that from a regional standpoint, ABAG will serve as a resource group for the counties in implementing the plans. ABAG should assume the role of conceiving and coordinating an education program. Education is a major element of each county's SRMP. Another ABAG responsibility should be the preparation of model ordinances for the counties. Additionally, ABAG should be the clearinghouse for funds which might be forthcoming from the State or Federal Government to assist in plan implementation.

Runoff Pollution Problems

An easily identifiable problem in the study area is sedimentation of the lower reaches of Sonoma Creek and the Petaluma River and adjacent tidal areas. This problem should be separated into that caused by the natural background sediment load of the streams and any additional load which can be attributed to currently ongoing human activities.

The effects of this problem appear to be aggravated and magnified by past construction of levees and land fills in the tidal areas. Confinement of the natural waterway by levees has accelerated sediment buildup in the remaining unleveed area. As a result, the flood carrying capacity of the remaining area is gradually diminished by sedimentation and soon the levees begin to lose their effectiveness. The loss of levee effectiveness is a sedimentation problem partially created by land reclamation practice without consideration or understanding of the long term effects and probably by increased sediment from erosion causing human activities in the upper watershed. Even though the effect of the problem is reasonably clear, the precise causes are not.

Sediment from erosion is decreasing the capacities of downstream and tidal waterways. Over one million cubic yards of sediment due to surface runoff is estimated to have reached the Petaluma River between Washington Street and the Highway 101 bridge during the last 16 years. This amount of material was dredged out by the Corps of Engineers at public expense to maintain a navigable waterway.

Some tributaries to the Petaluma River northwest of Petaluma are over 50 percent filled with sediment but it may be from natural sources. Public funds have been and will need to be used to remove this material from critical reaches of the waterway.

Sonoma Creek during flood flow has high sediment loads. The source of the sediment is diverse. Much of it comes from the land starting with rain droplet impact splash and the small flow concentrations and sheetflow. In streams there is an ongoing dynamic erosion process, but the net

contribution attributable to this source is difficult to estimate. Past gravel operations in Sonoma Creek have probably increased susceptibility to erosion.

Adoption of erosion control ordinances will begin to limit the sediment produced by human activities.

The U. S. Corps of Engineers (COE) has initiated a study of Sonoma Creek Basin regarding land use impacts on hydrology and related matters such as sedimentation. It is the purpose of the COE study to determine the hydrologic sensitivity of the basin to existing land uses and land use changes. That plan is scheduled for completion in mid-1979. That is near the end of the initial phase of this plan and is expected to be very helpful in assessing the future direction of this plan at that time.

Surveys and Research

Many public agencies were contacted with little success in pursuit of reports and studies which might assist in identification of problems in the Sonoma and Petaluma Basins. There is virtually nothing documented on the quality of storm water runoff in these two basins. Much has been speculated regarding polluted runoff waters, but most information is about dry weather flow conditions, not related to storm runoff.

The cities of Sonoma and Petaluma were sent questionnaires on control measures and management practices. The questionnaire was intended to stimulate the thought process on understanding how surface waters can become polluted and yielded the following feedback from the cities. Both cities have street sweeping programs and use some pesticides and herbicides for parks and roadside weed control. Each city has a litter control program and restrictions on dumping of waste of any kind in storm drain inlets. There are very few true catch basins (designed specifically to trap sediments) in the two cities; however, inlets tend to be a collection point for street debris. Both cities generally feel that an adequate job is being done on pollution control. The City of Petaluma (which has about 6 times the population of Sonoma) feels that if additional funds were made available for more efficient street and storm inlet cleaning equipment and additional maintenance personnel were made available, the current street cleaning program could be upgraded to reduce pollutants reaching the receiving waters. The City of Petaluma feels that their current erosion control practice is effective if inspection is adequately maintained. The City of Sonoma feels that control of developer's grading and landscaping plans, which are subject to city approval is effective. Education efforts to advise the public of ways to avoid polluting activities was considered desirable.

The questionnaire did not address rural management practices. Random observations were made of land use practices in both the urban and rural areas of the Petaluma and Sonoma Basins. In general, it was found that land use activities were not significantly different in these two basins than other Bay Area counties, except less intensified in Sonoma County because it is less urbanized. However, there are many pollution causing land use activities which can be corrected if people can be educated as to the long term impacts of some of their seemingly insignificant activities.

The most obvious problem that should be dealt with first is soil loss. This occurs from both man-induced and natural activities. Natural activities include erosive velocities in natural water courses. Even though this occurs naturally there are human practices which can reduce this activity and can produce economic benefits as well as environmental enhancement to wildlife and fisheries.

The following tabulations designate certain events or conditions which other agencies identified as site specific pollution problems and which might contribute to surface runoff pollution of the receiving waters.

Petaluma Basin
Suspected Problems

Source of Information	Type of Data
EPA	Public health problems due to failing septic tanks & unsuitable leach fields
NPDES	Chicken manure stored in diked area; occasionally washed into creek
NPDES	Potential runoff from land area used for disposal of process waste, washwater & duck waste
RWQCB	500 GPD of treated process & domestic waste to land
Son.Co.Pub. Health Service	Septic systems malfunctioning--wells contaminated 1/16/75, 3/20/75
NPDES	Water from filter backwash & alum sludge twice a year to drainage ditch
Basin Plan	Algal growths occur in river & the estuary Low dissolved oxygen
NPDES	Storm water runoff from fuel oil & storage facility
(unknown)	Floating vessels discharge waste into river
NPDES	Wet & dry weather discharge of rock quarry wash

Sonoma Basin
Suspected Problems

Source of Information	Type of Data
Son.Co.Pub. Health Service	Areas served by septic tanks--potential problem
"	Rock quarry siltation of Calabazas Creek
"	Numerous residences along Sonoma Creek pump from creek for irrigation, thereby reducing flow which results in poorer water quality
"	Ag. pollution--dairy waste discharge, dry manure placement, turkey waste, vineyards, wineries & cattle feedlots; Son.Co. dump--possible source; urban runoff
Basin Plan	Low dissolved oxygen excessive growth of algae in lower Sonoma Creek
RWQCB	Land application of stored & treated domestic sewage from Sears Point Raceway

Problem identification at the ABAG sponsored rountable discussions and at the Citizens' Advisory Committee and Technical Advisory Committee meetings was really identification of suspected problems. Monitoring of actual surface water pollution and subsequent monitoring of the actual effect on the flora and fauna of the streams, the bay and tidal areas will be necessary to verify that a particular suspected problem is actually a real problem.

Additional data on suspected problems and locations are in the Appendix.

Monitoring Program

The monitoring program was designed to provide baseline and pollutant loading data typical of the planning area. A study of the planning area was made to find the most representative and data productive watershed to demonstrate those values.

The upper Sonoma Creek watershed was found to be the prime candidate for demonstration watershed and was chosen for the following reasons:

1. It was sufficiently typical of either of the two planning area basins as to ratio of open and urban land uses.

2. The Sonoma Creek Basin has an active USGS stream gage at the Agua Caliente Road monitoring site.

3. There is a specific land use plan for the demonstration watershed recently adopted by the County Planning Commission.

The monitoring program was an eight county Bay Area effort. Sonoma County's demonstration watershed was rural. Other counties monitored more urban watersheds. The intent was to have a mixture of representative demonstration watersheds and a sharing of resultant data. Because of the lack of rainfall, rural watersheds did not produce runoff representative of typical average year conditions. Therefore, the modeling calibration and output was not as effective in Sonoma County as was originally anticipated.

Ideally, there should be several years of monitoring records to firmly establish the most likely real world values for this specific planning area.

Modeling Program

A watershed computer model is a mathematical representation of certain chosen characteristics of a watershed. The model is first calibrated to truly represent the watershed characteristics for chosen or known input data and known result. The model is then used by entering data of special interest to see what the result will be. This allows the model user to investigate a variety of hypothetical watershed conditions and to make predictions as to future events if the watershed conditions change as predicted.

Two water quality computer models were available to investigate possible pollution loadings in surface runoff. The Macroscopic Planning Model (MAC) can estimate the volume of runoff and loading of pollutants for a variety of land uses from a large watershed. Land uses, adjusted national average pollution values, and precipitation data were used as input information. This model can provide estimates of total pollution loads reaching the Bay.

The Storm Water Management Model (SWMM) enables the user to analyze and evaluate the effects of future land use options and the effect if certain control measures were implemented. This model was only partially calibrated and was not used in determining control measure alternatives. Lack of local monitoring data prevented correct calibration of this model. SWMM can be used in the future as a means of predicting change in water quality due to change in land use or land management practice.

The counties met on May 18, 1977 to select quantity and quality baseline data by land use and sub-area. The source data consisted of approximately 2,500 samples from national data plus 78 local storm results from 32 demonstration watersheds (454 samples). The national data base was adjusted using local data to arrive at a local data baseline. Additional discussion of the modeling effort is contained in the Appendix.

Control Measures

The initial planning period includes certain proposed action measures to effect control of conditions or materials which may cause surface water pollution. The following discussion elaborates on those control measures including initiation of the County implementation program.

a. Surface Runoff Quality Committee (SRQC)

A Surface Runoff Quality Committee is to be formed. The Committee must have continuous staff support from a responsible agency. The Committee will direct implementation of the plan and review all local agency land use proposals for compliance with the goals and objectives of this plan. Formation of the Committee will require a joint powers agreement between the cities and the County. It will be the responsibility of the local agencies with ABAG assistance to see that the SRQC is formed.

The SRQC will provide the necessary framework and ongoing impetus to initiate and carry on the designated actions proposed by this plan. The Citizens Advisory Committee and the regulatory authority of the County and two cities will provide the check and balance needed to assure that the plan will be implemented to the maximum degree possible consistent with the local agency's capability to do so. This process appears to be fully within the spirit of the EPA directive that the plan be locally conceived and locally implemented.

The SRQC will develop criteria for implementation of Best Management Practices (BMP). As this criteria is developed and evaluated by monitoring, it should be set up in a form to be shared with other agencies. The criteria should be used to verify, modify or delete from the specifications which Woodward-Clyde Consultants developed

for urban areas and which the Council of Bay Area Resource Conservation Districts developed for rural areas. Criteria should not require practices or designs that are beyond the scope of available technology for implementation or actions that are beyond the enforcement capability of the County. Each case should be considered on its own merit.

By law, the Surface Runoff Management Plan (SRMP) will be updated annually. Each year the SRMP will show the proposed specific actions to be taken the following year and actions for the subsequent five years will be general in nature.

The SRQC will make annual reports on the actions taken and evaluate the procedures and success of the SRMP. A copy of the annual report will be submitted to the San Francisco Bay Regional Water Quality Control Board and ABAG for their over-review of the success and effectiveness of the SRMP.

b. Responsible Lead Agency

Implementation of the plan will require designation of an agency responsible for staff support of the Surface Runoff Quality Committee. The responsible agency will provide a coordinator for the surface runoff plan and all other necessary services such as clerical and filing. Under a joint powers agreement the three parties "County of Sonoma, City of Sonoma and City of Petaluma" could designate any department under their jurisdiction as the responsible agency. As an alternate a fourth agency "Sonoma County Water Agency" could be considered and designated "Responsible Lead Agency" but that might require a change in the State Act which formed the Water Agency.

c. Education

Education of the public may be the most significant action which can be taken not only as to willingness to control individual acts which cause pollution but also willingness to support public agency action to adopt and enforce pollution regulation.

It should be recognized, however, that such education is already underway. The general public awareness of environmental concerns has increased in the past few years. There is widespread exposure to environmental education from kindergarten to the highest levels of the nation's colleges and in the news and entertainment media.

The effect of this education was evident at the various meetings with the public. There was virtually no objection to the concept of control or mitigation of pollutants in surface water runoff. The issue is what are the real problems, who is responsible for implementation and who pays.

Education specifically aimed at surface runoff pollution is needed as outlined in the assessment summary to give the public the opportunity to respond in a positive manner.

Education will not be accepted by all the people. For that reason, the regulatory ordinances are required. The trend of the public's awareness and willingness to voluntarily self regulate their impact on surface runoff pollution should be studied and known before complex and expensive programs are set in motion to enforce compliance.

The actions specified by this plan will initiate an organized education effort in an ongoing program to keep the public informed about good practice.

d. Erosion Control

Sediment is the material to which many pollutants will be attached as they move with the surface runoff. In addition to being a pollutant carrier, sediment is a pollutant. For that reason reduction of sediment load in the surface water is a significant step toward mitigation of pollution.

An erosion control ordinance would provide land·use criteria regulating disturbance of the earth so as to control the level of sediment which could be carried away by surface water.

e. Control of Chemicals and Littering

Chemicals are widely used in much of our day to day activities. Vector and plant disease control by public agencies and the private sector account for the largest and most obvious possible source of pollution. Spills of various materials, wear of autos and other equipment and natural decomposition of manmade products account for additional chemical pollution sources.

There is extensive regulation by EPA of agricultural chemical usage. We assume that this regulation will be continued and intensified if necessary. There is very little control of household chemicals except for warnings and usage instructions on the chemical containers. If household chemical usage is found to be a problem, EPA should take steps to secure proper usage. The agricultural interests in Sonoma County consider currently unregulated household usage to be more of a threat than the currently regulated agricultural use. Chemicals from automobiles and trucks either enter the air or fall to the street. The street residue can be partially removed prior to entering the surface water system by sweeping and/or vacuuming.

f. Street Sweeping

Street sweeping has the potential for removal of concentrated pollutants. Pollutants originating from the auto, litter from people and waste from pets collects in or near the gutter.

In the past street sweeping has been done primarily for aesthetic reasons. The litter and visible solid materials were removed to provide a visibly clean and pleasing appearance to the street.

It is now known that many pollutants are attached to fine sediments which are easily missed by conventional sweeping practice. Improved

sweeping would require more sweeper broom contact with the street surface, more complete coverage of the street, and more frequent sweeping prior to and during the rainy season. Better coverage would be obtained by parking regulations which would keep autos out of the parking lane when sweeping was scheduled.

Very little of the older urban development in the unincorporated County area has curbs and gutters. If street sweeping is found essential to pollution control, these areas would need curbs and gutters installed.

g. Ordinances and Enforcement

Regulation of the activities of the general public by laws and ordinances is seldom effective unless there is a clearly obvious need and the public believes that the regulation is important to their health, safety or general welfare. There are existing ordinances now in effect in Sonoma County which would to a large extent control many of the suspected pollutants if rigidly enforced. However, rigid enforcement of misdemeanor laws is notoriously ineffective and it would be naive to expect that trend to change for this plan. District Attorneys see their function as primarily in the prosecution of criminal offenses and tend to assume a low profile on non-criminal offenses. If compliance with regulatory laws is to be obtained, it seems logical that it will have to come about by a gradual process of education of the general public that such behavior is to their benefit and not by threat of severe punishment if they do not comply. Therefore, proposed new ordinances will provide the guideline for desired conduct of the public, but compliance may be expected only at such time in the future as the public considers compliance to be desirable and beneficial.

Nationwide implementation of surface water management is the goal of the Federal 208 Program. Failure of local entities to prepare, adopt and implement an acceptable program may lead to successively higher levels of regulation beginning with the Regional Water Quality Control Board and ultimately from the EPA. It should be emphasized that the Regional Water Quality Control Board now has the authority to regulate pollution from any source including non-point surface water.

Public Participation & SRMP Preparation

The public played an important role in the preparation of Sonoma County's Surface Runoff Management Plan. EPA mandated public involvement from the program outset, so as to utilize public resources to identify areas of concern, suggest possible solutions, resolve plan conflicts prior to public hearings, and to ensure the plan's political acceptability.

Two citizens committees were established to participate in the planning process. A small committee of individuals with technical background, the Technical Advisory Committee, helped in the technical aspects of plan formulation. A larger group, 43 in number, made up of people from diverse persuasions and walks of life, assisted in suspected problem identification, selection of potential control measures and action strategy review sessions. The committees met on five occasions during the year the plan was conceived and produced.

At several of the public participation meetings attendance was poor. In assessing the situation, it seems apparent that the study did not rank high on activity priority lists of the committee members. One member commented that her community was more concerned about two major planning proposals which if approved would destroy the "city center" concept of their newly updated general plan. Understandably, it is difficult for a municipality to rank a surface runoff management plan higher than two eminent planning projects. There was good attendance of interested groups who would be affected by plan implementation. These groups were very helpful in giving input to the process.

Citizen involvement at meetings was helpful in identifying suspected local surface runoff problems and potential solutions.

208 Programs Relationships

The relationship of the Sonoma County SRMP to the non-designated area surface runoff plan covering the remainder of the County being prepared by the North Coast Regional Water Quality Control Board (NCRWQCB) is presently difficult to assess. Probably the differences are most easily discussed. The ABAG 208 Program considers non-point source pollution of San Francisco Bay emphasizing those problems which are generally urban in nature. The NCRWQCB study addresses problems in waters which are tributary to the Pacific Ocean and are predominantly rural. The two lead agency staffs have met and discussed the possible commonalities of the two studies. The writers of this plan attended one of the NCRWQCB citizens' committee meetings to get a "feel" of the content and direction of that study. The NCRWQCB staff has received Sonoma County's draft SRMP for their evaluation. At this point in time, it appears premature to identify areas of common concern for solution by integration of the two studies. The NCRWQCB program has not progressed to the extent that integration is presently possible.

The implementing authority for this plan should review the NCRWQCB surface runoff program when complete and coordinate common activities where feasible and desirable.

Funding the Program

The Surface Runoff Management Plan in its initial stage will necessarily be a locally funded program. At this time it is assumed that little or no State or Federal monies will be available for local surface runoff management programs. Therefore, this plan has been designed to be funded and implemented locally for the initial planning period from July of 1978 through June of 1980. Cost of the program during the initial planning period will be approximately $154,100.00 or $77,050.00 per fiscal year. Some possible alternatives for program funding are as follows:

1. A tax rate increase of $.03/$100.00 assessed valuation in SCWA Flood Control Zone 2A (Petaluma) and $.04/$100.00 assessed valuation in SCWA Flood Control Zone 3A (Sonoma).

2. A Countywide SCWA tax rate increase of $.008/$100.00 assessed valuation.

3. A Sonoma County property tax rate increase of $.008/$100.00 assessed valuation. This is assuming the 208 lead agency to be other than the Sonoma County Water Agency.

4. The use of State or Federal monies to offset local costs in either of the first three alternates.

Initiation of the program and implementation of control measures will be contingent on availability of local funds. Such funds will have to be politically approved and locally budgeted. The initial phase of the plan may need to be curtailed to fit local funding capability.

The Initial and Continuing Planning Process

The initial planning period (1978-1980) follows a "low cost" and "go slow" principle until pollution problems from surface runoff are better understood in Sonoma County. If after two years of investigation, documentation, and educational programs it is determined that substantial problems exist, the continuing planning process will need to be initiated. In that following period, between 1980 and 1983, specific control measures will be implemented to mitigate known and continuing runoff problems which were identified and/or substantiated during the initial planning phase.

The basic strategy for the continuing planning period is to delay implementation of control measure actions which are cost-action intensive.

If monitoring fails to demonstrate improvement in runoff conditions, follow-up actions will become both more costly and more regulatory in nature until the EPA 1983 goal is met. However, unless runoff constituents are determined by scientific verification to be significant polluters of receiving waters, it is conceivable that the continuing planning process may never be instituted. Furthermore, if it is initiated, less intensive control activities may achieve the clean water goal before the EPA deadline.

It is anticipated by EPA that the SRMP will be updated annually to change the direction of implementation based on new information, changed needs and current local agency capability.

Monitoring of the streams and receiving water will provide the necessary technical data to more clearly identify pollutants and pollutant sources. Changes in the assimilative capacity of the receiving water and of the sources of pollutants may require a change in plan emphasis. The capability of local agencies may be increased or decreased by factors such as State and Federal legislation thereby affecting their implementation capability.

The continuing planning approach will allow for adjustment of the plan in an orderly, regular manner so that implementation effectiveness can be maximized.

The annual report prepared by the Surface Runoff Quality Committee along with recommendations submitted by Regional Water Quality Control Board and EPA shall be used as guides for future actions in implementing the SRMP.

Plan Summary Tables

The Plan Summary Tables explain the actions proposed for the initial planning period 1978-1980 and other appropriate actions which can be selected for implementation for the continuing planning process through the year 1984. The Plan Summary Tables contain recommended policies or actions, a general description of the policy or action, who will be the implementing agency, a time schedule for the activity, a notation of the legal authority, potential financing mechanisms, cost, who will have enforcement or regulatory responsibilities, and a notation of incentives which might accrue by implementing the activity.

The tables provide the reader with brief, concise data more easily understood than if in a narrative form.

The 1978 to 1980 section of the tables presents those actions which will be implemented as the initial phase of the plan. The remaining tables present the continuing planning actions to be implemented if the need to reduce surface runoff pollution loadings is demonstrated. At the time of update of the plan, all actions would be reassessed and those actions necessary to control pollution would be considered for current planning year implementation.

TABLE A

PLAN SUMMARY-1978 TO 1980

The following actions through the fall of 1980 demonstrate best management practice until monitoring indicates more intense actions need to be taken

Recommendations	General Description	Implementing Agency
S-1 PROGRAM ADMINISTRATION		
Action S-1.1 Create Surface Runoff Quality Committee (SRQC)	to guide surface runoff management plan implementation	SCWA*, Co.Health Dept., Co. Ag. Comm., Co. Sanitarian, Co. Farm Adv., Petaluma Pub.Wks., Sonoma Pub. Wks., Co.Rd.Dept., Reg. Water Quality Control Bd., CA Dept. of Fish & Game, Res.Conservation Dists., Co. Planning, ABAG, news media
Action S-1.2 ordinance review	all ordinances pertaining to surface runoff quality will be reviewed & evaluated for effectiveness	SRQC*
Action S-1.3 documentation of past & existing problems	research files of jurisdictions & agencies, SRQC members, for past problems & field investigations for existing problems	Lead Agency staff*
Action S-1.4 backup storm runoff monitoring	establish mobile monitoring stations in Petaluma & Sonoma watersheds; tentatively propose to monitor storms if data unavailable from other sources	sanitation districts, private consultants, Water Quality Control Board
Action S-1.5 draft erosion control ordinance	an ordinance which would prevent and/or mitigate erosion problems caused by man's disturbance of the ground	SRQC*, Bd./Supervisors, citizens comm. representing construction, ag. & env. interests
Action S-1.6 adopt erosion control ordinance	ordinance drafted by SRQC & citizens committee--adopted	Bd/Supervisors/ County Counsel

*Primary responsible implementing party

Schedule of Actions	Legal Authority	Financing Mechanism & Costs	Regulation & Enforcement	Other Incentives
commence summer 1978, meet monthly & as necessary	city councils & Bd/Supervisors resolution	city, county, state & federal funding--$60,000 Lead Agency costs & $2,700 other agency committee costs	annual rept. to Water Quality Control Bd., EPA - ABAG	
commence fall 1978	local resolutions as req'd.	city & county funding--for cost see Action S-1.1		
commence fall 1978 ongoing	city councils/ Bd/Supervisors directives	city, county, state & federal funding--for cost see Action S-1.1		establish data base
commence winter 1978-ongoing	Water Quality Control Bd.,EPA	local, state & federal funding--$2,500	Water Quality Control Bd.	develop data base
commence spring 1979	Bd/Supervisors directive	local funding--$2,500		
winter 1979	local resolution as appropriate	local funding		establish basis for jurisdictions to insure proper grading

TABLE A - PLAN SUMMARY-1978 TO 1980 - continued

Recommendations	General Description	Implementing Agency
Action S-1.7 encourage cooperation & coordination	a concerted effort will be made to encourage all agencies involved in maintenance of water quality to cooperate in & coordinate their activities	SRQC*
Action S-1.8 establish resource recycling subcommittee of SRQC	committee composed of public & private members would investigate feasibility of recycling sites & litter control ordinances & household chemical recycling programs	SRQC*, cities of Sonoma & Petaluma Pub. Wks.Depts., refuse companies, environmental groups, Son.Co. Dept. of Pub.Wks., petroleum industry representatives & ABAG
Action S-1.9 public works activities	insure that public agencies involved in construction & maintenance activities utilize best management practices relative to erosion prevention	SRQC*, Son.Co.Pub.Wks. Dept., SCWA
S-2 EDUCATIONAL PROGRAMS		
Action S-2.1 land management values	introduce public educational programs in school curriculum, libraries, public facilities & news media which emphasize good land management values	ABAG*, County School Supt., school districts, library districts, local news media, cities of Sonoma & Petaluma, Son. County 208 coordinator
Action S-2.2 news media alert	media will alert public & private of existing runoff problems	208 coordinator*, news media/SRQC
Action S-2.3 spray research	encourage the research of long term side effects of the chemicals in environment	EPA*
Action S-2.4 spray education	introduce educational programs informing public of proper management practices relating to the use of sprays in non-agricultural areas	ABAG*, Ag. Comm., Farm Advisor
Action S-2.5 ground disturbance	with each bldg. & grading permit, a notice will be issued explaining potential consequences of construction & grading operations where ground disturbance occurs	208 coordinator*, Son. Co.Bldg.Dept., cities of Sonoma & Petaluma Bldg. Depts.

*Primary responsible implementing party

Schedule of Actions	Legal Authority	Financing Mechanism & Costs	Regulation & Enforcement	Other Incentives
commence winter 1978	local resolution as appropriate	for cost see Action S-1.1		
commence fall 1978	Bd/Supervisors & city councils resolutions	local funding & private--for cost see Action S-1.1		
commence summer 1978	Bd/Supervisors & Bd/Directors, SCWA, directives	local funding--for cost see Action S-1.1		
commence winter 1978-ongoing	EPA, ABAG, state	local, regional state & federal funding	SRQC	promote public consciousness, clean waters for recreation
commence winter 1978-ongoing	SRQC	city, county, state federal & private funding--for cost see Action S-1.1		promote public consciousness
commence summer 1979-ongoing	SRQC, Bd/Supervisors	state & federal funds & ABAG		promote public consciousness
commence summer 1979	SRQC, Bd/Supervisors & city council directives	ABAG & local		promote public awareness, protect health & safety
commence summer 1978-ongoing	SRQC, Bd/Supervisors & city council directives	local funding--$400.00	UBC & County grading ord., Son.Co.Ords. 339 & 1108, WQCB	clean water for recreation, protect eco-systems, aesthetics

TABLE A - PLAN SUMMARY-1978 TO 1980 - continued

Recommendations	General Description	Implementing Agency
Action S-2.6 fire damage	info & instructions re. reseeding programs desirable after rangeland, brush & timber fires	208 coordinator*, Son. Co.Ag.Comm., USDA, Ag. Stabilization & Conservation Off., Resource Conservation Dists., fire protection dists.
Action S-2.7 septic system maintenance	notices describing proper homeowner maintenance of private septic systems will be included in tax bills--notices will also be issued w/ bldg.permits for new systems	208 coordinator*, Son. Co.Depts.of Env.Health & Bldg.
Action S-2.8 best management practices manual	info. manual written to inform of best management practices as they relate to water quality	SRQC*, Ag. Comm., Farm Adv., Resource Conservation Dists.
A-2 IMPROVE STREET SWEEPING		
Action A-2.1 document existing & past problems--verify sweeping schedules--Co. street sweeping policy to be established	photographing, field notes, inspections--verify sweeping plans w/actual sweeping activity	SRQC*, cities of Sonoma & Petaluma Pub.Wks.Depts., Son.Co.Pub.Wks.Dept.
Action A-2.2 modify activity	concentrate sweeping programs prior to rainy season	SRQC*, cities of Sonoma & Petaluma Pub.Wks.Depts., Son.Co.Pub.Wks.Dept.
Action A-2.3 impose parking restrictions	restrict parking in certain areas during sweeping times to allow unrestricted access to curb areas	SRQC*, cities of Sonoma, & Petaluma Pub.Wks.Depts., Son.Co.Pub.Wks.Dept.
Action A-2.4 initiates sweeping program	sweeping implemented in high density unincorporated areas where curbs & gutters exist	Son.Co.Pub.Wks.Dept.*
Action A-2.5 policy to establish rural street drainage -sediment control stds.	in unincorporated areas w/o curbs & gutters, policies will be formulated to pre--vent sediment & debris from entering waterways	Son.Co.Depts. of Pub. Wks.*, Comm. Develop./ Environ. Services
A-4 CONTROL USE OF CHEMICALS & RECLAIMED WATER		
Action A-4.1 monitor pollutants & buildup from use of reclaimed waters	info. on pollutant buildup will be given farmers utilizing reclaimed waters for ag. activities	WQCB*, Co.sanitation dists., Cities of Sonoma & Petaluma Pub. Wks.Depts.

*Primary responsible implementing party

Schedule of Actions	Legal Authority	Financing Mechanism & Costs	Regulation & Enforcement	Other Incentives
commence summer 1978-ongoing	SRQC & Bd/ Supervisors directives	local, state & federal funding-- $400 local cost	WQCB	revegetation of forage crops, wild-life mitiga-tion, aesthe-tics, erosion control
commence summer 1978-ongoing	SRQC & Bd/ Supervisors directives	local, state & federal funding-- $400 local cost		more efficient systems--cost saving
commence spring 1979	EPA, ABAG, State, SCS	local funds-- $5,000		public awareness
commence summer 1978	city council directive, Bd/ Supervisors directive	county funds--$2,000 lead agency cost	SRQC	aesthetics, eco-system protection
commence fall 1978-ongoing	city council directive, Bd/ Supervisors directive	city & county funds--no cost increase	SRQC	aesthetics, eco-system protection
commence fall 1978	city ordinances	city & county funds--$500	citations & fines	urban aesthetics
commence summer 1979	Bd/Supervisors directive	local funds-- $44,600		urban aesthetics
commence winter 1979	Bd/Supervisors directive	local funds-- $5,000		urban aesthetics
commence summer 1979-ongoing	Bd/Supervisors directive, Cities of Sonoma & Petaluma directives	local funds-- $2,000		continued productivity, fisheries & wildlife enhancement

TABLE A - PLAN SUMMARY-1978 TO 1980 - continued

Recommendations	General Description	Implementing Agency
Action A-4.2 spray regulation	encourage statewide control of herbicides & pesticides used in non-agricultural activities	EPA, State
A-6 LITTER & SOLID WASTE CONTROL		
Action A-6.1 litter control ordinances	draft & adopt ordinances controlling litter	ABAG, SRQC*, Cities of Sonoma & Petaluma Pub.Wks.Depts., Son. Co.Depts. of Pub.Wks. & Env. Health
B-12 DRAINAGE ORDINANCE		
Action B-12.1 ordinance	a drainage ordinance will be drafted and adopted which will relate to general plan open space, resource & public safety policies	SRQC*, Son.Co.Planning Dept., State Dept. of Fish & Game, WQCB

*Primary responsible implementing party

Schedule of Actions	Legal Authority	Financing Mechanism & Costs	Regulation & Enforcement	Other Incentives
commence fall 1979	State legis.	state	state	public awareness, eco-system protection
commence summer 1978	Bd/Supervisors resolution, Cities of Sonoma & Petaluma resolutions	local funds--$2,500	adopted ordinances/penalties	energy conservation, aesthetics, economic motives, resource conservation
summer 1978	Bd/Supervisors & Cities of Sonoma & Petaluma resolutions	local funds--$2,500	adopted ordinances/penalties	aesthetics, fish & wildlife enhancement, reduced cost for public services, retention of top-soil on site

TABLE A

PLAN SUMMARY-CONTINUING PLANNING

These items are continuing planning actions to be implemented only if pollutant loading demonstrates the need

Recommendations	General Description	Implementing Agency
A-2 IMPROVE STREET SWEEPING		
Action: increase number of curb miles	increase curb miles in sweeping, incl. new areas & more intensity in existing areas	Son.Co.Pub.Wks.Dept. Cities of Sonoma & Petaluma Pub.Wks.Depts.
Action: Vacuum sweeper	utilization of vacuum sweeper	Cities of Sonoma & Petaluma Pub.Wks.Depts. & Son.Co.Pub.Wks.Dept.
Action: consider increasing scope of sweeping	investigate necessity of moving sweepers into areas not currently swept & increasing intensity in areas already being swept	Cities of Sonoma & Petaluma Pub.Wks.Depts.
A-3 REPAIR STREETS		
Action: initiate repair programs	begin repairing streets to facilitate street sweeping	Cities of Sonoma & Petaluma Pub.Wks.Depts.
Action: step up repair actions	surface treatment overlays, replacing ramped driveways with depressed driveways	Cities of Sonoma & Petaluma Pub.Wks.Depts.
A-4 CONTROL USE OF CHEMICALS		
Action: increase surveillance	step up efforts to insure spray operations are performed according to management plans & labeling instructions--activity will be triggered by spray residuals being carried in runoff waters	water quality inspectors Farm Advisor, WQCB*, Health Dept., SRQC
A-6 LITTER & SOLID WASTE CONTROL		
Action: establish neighborhood compost	locate neighborhood composts for home landscaping wastes	water quality inspectors, Farm Advisor, WQCB*, Health Dept., SRQC
A-9 DIRECT POLLUTANT DISCHARGE		
Action: establish neighborhood recycling site	site will be established for disposal of household chemicals & petroleum products	SRQC*, Cities of Sonoma & Petaluma Pub.Wks.Depts., Son.Co.Depts.of Pub.Wks. & Env. Health & reps. of petroleum companies

*Primary responsible implementing party

Schedule of Actions	Legal Authority	Financing Mechanism	Regulation & Enforcement	Other Incentives
to be developed with annual continuing planning work programs	City Council directives	city funds	SRQC	urban aesthetics
"	Bd/Supervisors & City Councils	city, county, state & federal funds		urban aesthetics
"	city ordinances	city funds	citations & fines	urban aesthetics
"	City ordinances	city funds	SRQC	safety, reduced liability, aesthetics
"	city ordinances	city funds	SRQC	safety, reduced liability, aesthetics
"	Bd/Supervisors directive	local funds	ordinance/ penalties	continued productivity, fisheries & wildlife enhancement
"	Bd/Supervisors directive	local funds		produce organic material for gardening, energy conservation
"	Bd/Supervisors & Cities of Sonoma & Petaluma resolutions	local & private funds		resource & energy conservation, economic benefits, eco-system protection

TABLE A - PLAN SUMMARY-CONTINUING PLANNING - continued

Recommendations	General Description	Implementing Agency
Action: system of recycling sites	if monitoring of first action listed under A-9 above demonstrates need, a network of neighborhood disposal sites will be established	SRQC*, Cities of Sonoma & Petaluma Pub.Wks.Depts., Son. Co.Depts. of Pub. Wks. & Env. Health & reps. of petroleum companies
A-13 STORM SEWERS & DRAINAGE CHANNELS		
Action: clean storm sewers & drainage channels	storm sewers & drainage channels to be cleaned periodically, especially prior to advent of rainy season	SCWA, Son.Co.Pub. Wks. Dept., Cities of Sonoma & Petaluma Pub.Wks.Depts.
A-14 OPEN CHANNELS		
Action: clean open channels	flood control channels cleaned for sedimentation	SCWA, Son.Co.Pub. Wks.Dept., Cities of Sonoma & Petaluma Pub.Wks.Depts.
A-7 CONTAMINANTS FROM DOMESTIC ANIMALS		
Action: notification of overgrazed conditions	if it is observed that cover on previously overgrazed lands has not improved, owners shall be notified & requested to seek advice from their resource conservation district	WQCB, water quality inspectors, Farm Adv. Off., Ag.Comm., SRQC
Action: range management plans	if range management shows no substantial improvement in quality of runoff waters, WQCB shall instruct farmer to correct range management problem	Bd/Supervisors, SRQC, Farm Adv., Ag. Comm., Farm Bureau & Ag. Stabilization & Conservation Office
Action: enforcement	best management practice concepts & range management plans will be enforced	WQCB*
B-10 STREAM CHANNELS		
Action: Stabilize stream channels	erosion prone areas stabilized to reduce or eliminate erosion	SCWA
S-1 PROGRAM ADMINISTRATION		
Action: drainage review	drainage review w/respect to water quality will be included in development review process	SCWA, Proj.Rev.Adv. Comm.(PRAC), WQCB, Son.Co.Env.Health
C-1 TREAT & STORE RUNOFF		
Action: treat & store runoff	storm runoff will be treated & stored	SCWA, Proj.Rev.Adv. Comm.(PRAC), WQCB, Son.Co.Env.Health

*Primary responsible implementing party

Schedule of Actions	Legal Authority	Financing Mechanism	Regulation & Enforcement	Other Incentives
to be developed with annual continuing planning	Bd/Supervisors & Cities of Sonoma & Petaluma resolutions	local & private funds		resource & energy conservation, eco.benefits, eco.system protection
"	Bd/Supervisors & Cities of Son. & Petaluma	local funds		eco.system protection, aesthetics
"	SCWA District Act, Bd/Supervisors & City Councils	district zone tax, local funds		
"	SRQC, Bd/ Supervisors resolution	local funds		continuing education
"	Bd/Supervisors & City Councils resolutions	local & private funds	ordinances/ penalties	more eco.op., wildlife enhancement, reduce cost for pub.service, retention of topsoil
"	WQCB	local & state funds	Porter-Cologne Act	
"	SCWA Dist.Act	district zone tax		
"	Bd/Directors SCWA	private development review fees		
"	WQCB mandate, Bd/Supervisors & Cities of Son. & Petaluma directives	state, federal, local & special district funds	state & federal statutes	eco.system protection

Control Measure Assessment Tables

The control measure assessment tables summarize potential impacts to be expected when proposed action strategies are implemented.

Each control measure in this plan has been analyzed as to environmental economic, institutional, financial and social impacts. In analyzing the individual recommendations of the initial planning period, it became increasingly apparent that each action, if implemented, would trigger other actions, some beneficial and some not. Also of interest was the finding that most recommendations relating to improving the quality of receiving waters would open up various multiple use potentials, i.e. enforcement of erosion control ordinance could not only reduce siltation in receiving waters but also enhance fishing and aquatic recreation possibilities. Another example might be improved street sweeping in a central business district might eliminate potential health problems, clean up receiving waters, which increase urban visual amenities, and make a central business district a more desirable place to shop, possibly creating more employment opportunities.

The following control measure assessment tables (Table B) summarize potential impacts. The assessment tables were prepared only for the initial phase of the plan. Assessment of impacts of future control measures beyond the initial phase should be made at the time of development of such additional actions.

The assessment of each control measure was accomplished utilizing the following guidelines:

1. ABAG staff developed a detailed methodology for control measure assessment; this was provided in an "Assessment Procedures Manual".

2. Estimated costs for control measures were developed utilizing cost assessment technical memorandum No. 2 which was developed by ABAG. Several specific control measure costs were developed by using cost data supplied by departments/agencies performing similar activities, i.e., sampling and monitoring costs.

The assessment tables were prepared only for the initial phase of the plan. Assessment of impacts of future control measures beyond the initial phase will be made at the time of development of such additional actions.

TABLE B - CONTROL MEASURE ASSESSMENT SUMMARY

Control Measure/ Recommendation	Environmental Impacts
S-1 PROGRAM ADMINISTRATION	
S-1.1 Establish Committee S-1.2 Ordinance Review S-1.3 Documentation of Problems S-1.4 Backup Monitoring S-1.5 Draft Ordinances S-1.7 Encourage Cooperation S-1.8 Establish Sub-Committee S-1.9 Public Works Activities	N/A
Actual impacts can only be identified by site specific detailed assessment. Many impacts would be localized. The impacts noted are general impacts expected. Impacts noted for the policy are also impacts of actions and recommendations except where different or additional impacts are noted.	
S-1.6 Adopt Erosion Control Ordinance	Air Quality: indirect impact --dust associated w/ground disturbance should be decreased indirect impact--ordinance requirements could result in temporary degradation of air quality from exhaust emissions from equipment Water Quality: reduce coliform bacteria contamination of surface & groundwaters reduce nitrate concentration in groundwater & surface waters reduce algal blooms from high nutrient concentrations (especially during low flows) enhance beneficial uses of water bodies, fishing, boating, swimming & other contact sports, fish & wildlife propagation & sustenance, recharge of groundwater supplies, groundwater supply for irrigation & domestic supplies indirect impact--would reduce suspended solids loading in receiving waters

Institutional & Financial Impacts	Economic Impacts	Social Impacts
Financial: direct public cost of implementation of initial program thru Dec. 1979-$69,332±. Funds derived from property tax levy increase of 3/4¢ per $100 of assessed valuation. Institutional: direct impacts on lead agency staffing-adm.-monitoring direct impacts on legal capabilities in review, updating & drafting ordinances direct impacts on interagency & interjurisdictional coordination	N/A	N/A
Financial: direct impact--public costs relating to ordinance enforcement--funds generated from property tax levy Institutional: direct impact on agency with responsibility of ordinance enforcement--staffing needs direct benefit--resultant reduction in erosion related property damage; reduction in public costs	Income & Investment: indirect impacts--private costs of erosion control activities would be incurred indirect benefits would accrue due to more desirable recreation conditions ag. productivity could be lessened as a result of the ordinance	Housing Supply: indirect impacts--private costs of erosion control activities passed on to consumer; hence higher housing costs reduction in ag. productivity could increase consumer costs

Control Measure/ Recommendation	Environmental Impacts
S-2 EDUCATIONAL PROGRAMS S-2.1 Land management values S-2.2 News media alert S-2.3 Spray research S-2.4 Ground disturbance S-2.5 Fire damage S-2.6 Septic system maintenance S-2.7 Best management practices (impacts noted are general impacts expected)	As a result of educational activities the following indirect impacts might occur: Air Quality: instances of odorous conditions due to septic system failures should decrease Water Quality: reduce coliform bacteria contamination of surface & groundwaters reduce nitrate concentrations in groundwater & surface water reduce algal blooms from high nutrient concentrations (especially during low flows) enhance beneficial uses of water bodies, fishing, boating, swimming & other contact sports, fish & wildlife propagation & sustenance, recharge of ground-water supplies, groundwater supply for irrigation & domestic supplies Physical Resources: enhancement of fish & wildlife habitats, maintenance & regeneration of flora potential increase in fire hazard Amenities: visual amenity--benefits relative to pollutant loadings in water courses & erosion-free landscapes

Institutional & Financial Impacts	Economic Impacts	Social Impacts
Financial: direct impacts--public costs for implementation of educational programs. Costs will be multi-jurisdictional in nature & sources of funding will vary with each activity Institutional: direct impact on staffing of agencies involved in programs--probable augmenting of staffs would be required	Incomes & Investment: direct benefit to firms contracted to produce educational materials for programs. indirect impacts--ag. production & hence, profits could increase as a result of the educational programs Production of Goods & Services: direct impact--could provide minor employment opportunities	Consumer Expenditure: increase ag. productivity; could reduce consumer costs for products Sense of Community: program could promote public awareness & increase the sense of community

Institutional & Financial Impacts	Economic Impacts	Social Impacts
Financial: direct minor fiscal impact--no major capital costs County to experience minor fiscal impact related to costs in establishing sweeping program indirect benefit--revenues derived from fines levied for parking violations Institutional: direct impact--possible need for additional staffing for research direct impact--possible staff increase to enforce parking restrictions	Income & Investment indirect impact--increase in sales based on more desirable shopping place	Health & Safety: direct benefit--cleaner streetscape reduces potential public health problems indirect impact--could improve community pride & result in citizen involvement Physical Mobility: direct impact--minor effect on traffic & parking
Financial: direct fiscal impact--County to experience "start-up" capital & O&M costs Institutional: direct impact--County will need to establish capability of performing sweeping program	Production of Goods & Services: direct impact--could provide minor employment opportunities	same as A-2.1, 2.2, 2.3

TABLE B - CONTROL MEASURE ASSESSMENT SUMMARY - continued

Control Measure/ Recommendation	Environmental Impacts
A-4 CONTROL USE OF CHEMICALS & RECLAIMED WATER	
A-4.1 Monitor pollutant buid-up from use of reclaimed water on ag. lands A-4.2 Spray regulation	Water Quality: direct impact--reduces amounts of pollutants entering receiving waters Physical Resources: direct impact--major benefit to aquatic community direct impact--possible detrimental pollutant build-up in lands after prolonged application of reclaimed water Energy: on-site production of fodder precludes the need to transport feed from other areas
A-4.2 Spray regulation (non-agricultural activities)	Water Quality: direct impact--reduce amounts of pollutants entering receiving waters Physical Resources: direct impact--prevents indiscriminate use of pesticides & herbicides & insures protection of flora & fauna indirect impact--could reduce effectiveness of home spray programs

Institutional & Financial Impacts	Economic Impacts	Social Impacts
Institutional: direct impact--intergovernmental cooperation & coordination responsibilities direct impact--staffing of agencies involved in monitoring. Possible augmenting of staffs will be required Financial: direct impact--public costs for implementation, i.e. sampling & monitoring in those areas where waste waters are irrigated direct impact--on property tax --increased tax rate direct competition with other public services for limited funds	Production of Goods & Services: direct impact--use of reclaimed water increases ag. productivity could provide additional employment opportunities direct impact--local fodder production could increase ag. economic viability indirect benefit--the availability of on-site fodder could reduce consumer costs Income & Investment: direct benefit--availability of fodder--a cost saving direct benefit--increase in property values	Housing Supply: in direct impacts--use of reclaimed water removes certain lands from poss. development indirect impact--reduction in available lands for development could cause a rise in housing costs Sense of Community: indirect benefit--fodder production can contribute to green belting & a sense of community
Institutional: direct impact--minor staffing adjustments for agency involved in implementing activity Financial: direct impact--minor public costs in implementing regulations & for public educational programs	Production of Goods & Services: indirect impact--could conceivably cause economic liability for manufacturers of herbicides & pesticides	Health & Safety: direct impact--regulation of non-ag. uses of pesticides & herbicides could result in reduction of spraying accidents

TABLE B - CONTROL MEASURE ASSESSMENT SUMMARY - continued

Control Measure/ Recommendation	Environmental Impacts
A-6 LITTER & SOLID WASTE CONTROL	
A-6.1 Litter control ordinances	Air Quality: direct benefit--instances of odorous conditions should decrease emissions from collection equipment could be eliminated Energy: direct impact-- decreased fuel consumption in litter collection Water Quality: enhance beneficial uses of water bodies for fishing, boating, swimming & other contact sports, fish & wildlife propagation & sustenance recharge of groundwater supplies, groundwater supply for irrigation & domestic supplies demand on solid waste disposal capacities Amenities: direct benefits of visual impacts of debris removal from streambanks--preservation of natural state of environment & scenic resources
B-12 DRAINAGE ORDINANCE	
B-12.1 Adopt ordinance	Adopted & enforced ord. could have following effects on: Water Quality: direct impact--enhanced beneficial uses of water bodies for fishing, swimming & other contact sports direct benefit in retention & maintenance of fish & wildlife habitats in stream bottoms & riparian edges Physical Resources: creek corridor setback zone acts as a filter strip to control contaminants & as a wildlife habitat creek setback zone would protect vegetation along drainageways Amenities: direct benefit of preservation of natural state of environment & scenic resources

Institutional & Financial Impacts	Economic Impacts	Social Impacts
Financial: direct impacts--public costs for review, amendments &/or drafting ordinances. Costs will be borne by each jurisdiction (amplify costs) direct impacts--on property tax rate--increased tax rate Institutional: direct impact--on staffing of governmental units who have responsibility for administrating & enforcing direct impact--requires legislative action to implement	Production of Goods & Services: direct impact--production techniques could be modified by litter ord. could provide employment opportunities Consumer Expenditures commodity prices could become more expensive Income & Investment: could result in minor benefit to property values improved visual conditions could make a community business dist. a more desirable shopping area	Sense of Community: the visual qualities would improve in areas where litter ordinances are in force direct benefit--generation of management values in communities Health & Safety: litter control programs would control litter conducive to growth of vectors & other noxous species
Institutional: staff impacts on legal resources in drafting & adopting ordinance direct impact--after adoption jurisdiction responsible for implementation could have staffing requirements over & above current levels Financial: direct public costs in drafting & adopting ordinance direct public costs in implementing & enforcing ordinance indirect impact--retention of vegetation in setback zone could prevent creekbank erosion & save both public & private costs for erosion control	Income & Investment: direct impact--land previously considered developable might be included in creek setback zone indirect impact--adopted & implemented ordinance could increase adjacent land values Consumer Expenditures: indirect impact--cost of land could rise as a result of implementation Production of Goods & Services: direct impact--the prohibition of uses of certain lands along creeks & drainageways could prevent potential agriculture production	Housing Supply: direct impact--probable reduction in housing supply indirect impact--could reduce or eliminate likelihood of structural problems associated with slope instability Urban Patterns: direct impact--retention of riparian zones could have bearing on urban development patterns

CONTROL MEASURE ASSESSMENT

S-1 PROGRAM ADMINISTRATION

The general administration of the 208 Program, Actions S-1.1, 1.2, 1.3, 1.4, 1.5, 1.7, 1.8, and 1.9, will be free of environmental, social and economic impacts. Identifiable impacts lie in the realm of institutional and financial impacts.

INSTITUTIONAL AND FINANCIAL

Administration of the program will require staffing and equipment from the lead agency selected to administer the 208 Surface Runoff Management Plan (SRMP). It will be necessary to hire a 208 coordinator, provide clerical and material assistance, and staff to support Regional Water Quality Control Board activities.

The lead agency legal branch will be impacted by the review, drafting and amending of ordinances. Coordinating 208 efforts between agencies and jurisdictions will commit staff time and energies.

Program administrative cost is estimated at $60,000 for the initial planning period of 1978-1980. A tax levy of approximately 3/4¢ per $100 assessed valuation would be required to fund this activity. The cost to individual agencies having committee commitments will be approximately $1350 per year or $2700 for the initial planning period. Costs based upon one meeting per month x 12 months x $109 average salary = $1350± x 2 years = $2700±.

Backup monitoring costs have been determined to be approximately $2000 per storm. This includes sampling for the duration of the storm and laboratory analysis.

ACTION S-1.6 EROSION CONTROL ORDINANCE

ENVIRONMENTAL IMPACTS

The quality of air could improve with the adoption of an erosion control ordinance by reduction of dust producing areas. In complying with precepts of an ordinance, it is possible that exhaust emissions could temporarily degrade the quality of air.

A beneficial condition could be the reduction in pollution concentration in receiving waters and groundwater resources. General pollution could be lessened by enactment of erosion control ordinances and suspended solids and sediment loading would be reduced in receiving waters.

All of the above would enhance multiple use in receiving waters, i.e., fishing, swimming, boating, etc. Fish and wildlife propogation and habitat would be improved and sustained, groundwater quality would improve, recharge ability would be enhanced, and drainage capacity improved.

INSTITUTIONAL AND FINANCIAL IMPACTS

Drafting erosion control ordinances could have impacts on the responsible agency's staff. Drafting, legal review and publication or ordinance will result in direct public cost of $2,500.

Ordinance enforcement would require the enforcing entity to increase staffing to a level which would insure effective erosion control.

Funding for enforcement would be secured from a property tax levy.

Reduction in public costs resulting from the correction of erosion related property damages would be a benefit.

ECONOMIC IMPACTS

Erosion control activities resulting from compliance with the ordinance could significantly increase private development costs. Additionally, agricultural operating costs could be increased. Retention of top soil would enhance productivity.

Improved water quality could lead to improved economic conditions of business related to water oriented recreation.

SOCIAL IMPACTS

A potential impact could be an increase in cost of housing and agricultural products as a result of required erosion control activities.

S-2 EDUCATIONAL PROGRAMS

The institution of educational programs encompassing actions S-2.1 through S-2.7, could result in the following general impacts.

ENVIRONMENTAL IMPACTS

Public education on septic tank maintenance could reduce the incidences of septic system odors and contamination of surface and groundwaters.

The reduction of coliform count, nitrate concentrations, algae blooms and levels of suspended solids in runoff waters could significantly improve the quality of receiving waters for aquatic activities, i.e., swimming, boating, fishing, etc.; improved water quality could improve fish, wildlife habitat conditions and sustain propagation. Groundwater quality and recharge conditions could significantly improve.

Indirect benefits to the agricultural lands could result from improved water quality of irrigation supplies. Best management practices could result in reduction in chemical and sediment loading in irrigation supplies.

An improvement in visual amenities in both receiving waters and an erosion-free landscape could result from educational programs.

Vegetation and natural regeneration of flora would enhance fish and wildlife habitats.

Increased fire hazards during dry seasons would be an adverse impact.

INSTITUTIONAL AND FINANCIAL IMPACTS

Educational programs will require staffing and support activities at the regional level as well as the local level. Major staffing will be at the regional level. The creation of an education task force will impact those agencies and jurisdictions chosen to be seated on the task force.

The control measure's cost will be diverse as it will be spread among many different agencies and jurisdictions. Costs for a regional educational program relating to land management values could conceivably incur very significant costs, similar to those expended in the regional public participation task of the environmental management plan program. Local costs in production of informational pamphlets will be approximately $2,400 per year. Costs for production of a best management practices manual are estimated to be $2,500 per year.

ECONOMIC IMPACTS

Educational programs will foster direct economic benefits to firms contracted to produce educational materials for the programs.

If educational programs result in recycling, an economic benefit could be realized from recycling programs, i.e., oil reclamation, newspapers and aluminum.

As an indirect benefit, best management practices gleened from environmental education could increase agricultural productivity and subsequent profits.

Increased productivity could provide employment opportunities.

SOCIAL IMPACTS

Increased agricultural productivity could result in reduced consumer costs for agricultural products.

Public education program could promote public awareness and increase the public's sense of community.

A-2 IMPROVE STREET SWEEPING

This control measure is made up of several individual actions designed to improve street sweeping. These measures are general in nature and not site specific, correspondingly, impacts identified are likewise general. Individual actions A-2.1, A-2.2, A-2.3, A-2.4, and A-2.5 are assessed below.

ENVIRONMENTAL IMPACTS

Improved street sweeping could have a direct benefit in reducing vehicular pollution particulates, dust and litter which would enter receiving waters with storm runoff. Short-term impact of increased dust generation could be experienced while sweeping.

Increased sweeping activities could increase solid waste disposal demands. Fish and wildlife will benefit by reducing contaminants which reach receiving waters.

Intensifying sweeping activities will have a short-term impact relating to noises generated by sweeping operations. Another adverse impact is additional fuel consumption while intensifying sweeping activities.

Water quality could be significantly improved by reducing suspended solid loadings and toxic contaminants. Turbidity levels should be reduced by improving street sweeping and recreation potentials should be enhanced.

Improving street sweeping can decrease the turbidity levels of receiving waters and hence improve visual qualities.

INSTITUTIONAL AND FINANCIAL IMPACTS

Program development will have minor fiscal impacts. Inspections and documentation programs are estimated to cost \$1,000± for 9+ man days per year. The County of Sonoma will experience minor costs in developing a sweeping program.

Costs for parking restriction signs would be \$500± per year. Fines should produce revenues from those ticketed for illegal parking.

In developing a sweeping program, it is conceivable the County would have to augment its staffing for research. Also, in parking restriction enforcement it is probable that staff would have to be increased for enforcement programs.

In developing rural street drainage standards direct staffing and cost impacts could be 2 man months and publishing \$5,000.

ECONOMIC IMPACTS

It is possible that improving street sweeping will create a more desirable shopping place and hence increase sales and profits.

Improving sweeping by concentrating prior to the rainy season could cause a shift in employment patterns and could adversely affect personnel on a seasonal basis. Improving street sweeping could result in increased production of street sweeping equipment.

SOCIAL IMPACTS

Improved street sweeping could result in cleaner streetscapes reducing potential public health problems. Cleaner streets could result in an increase in civic pride and sense of community.

Improved sweeping programs could have minor impacts on traffic and parking during sweeping operations.

Initiation of a street sweeping program in the urbanized unincorporated areas of Sonoma County would be a significant action.

INSTITUTIONAL AND FINANCIAL IMPACTS

Initiating a sweeping program will result in direct and possibly major fiscal impacts for Sonoma County. "Start-up" and operational and maintenance costs would be involved.

Sonoma County would experience an impact as it relates to the staffing and training of personnel to carry out the street sweeping program.

ECONOMIC IMPACTS

County sweeping programs could provide employment opportunities.

A-4 CONTROL USE OF CHEMICALS AND RECLAIMED WATERS

This control measure includes actions A-4.1 and A-4.2 of the Surface Runoff Plan.

ENVIRONMENTAL IMPACTS

Controlling usage and monitoring can have the direct impact of reducing the amount of pollutants entering receiving waters. These actions will enhance beneficial uses of receiving waters and benefit the aquatic flora and fauna communities.

Control of chemicals and reclaimed water monitoring could prevent a detrimental buildup of pollutants on lands after prolonged application of treated waters; hence reducing the potential to degrade the quality of surface runoff.

On site production of fodder precludes the need to transport feeds from other growing areas, hence saving energy and reducing air pollution.

Spray regulations for chemicals used in non-agricultural activities could prevent indiscriminant use of pesticides and herbicides and ensure protection of flora and fauna.

Spray regulations could result in reduced availability of effective materials for home spray programs.

INSTITUTIONAL AND FINANCIAL IMPACTS

Implementing this control measure could have a staffing impact resulting from coordination and cooperation in the activity.

Fiscal impacts can be expected in control measure implementation and in the sampling and monitoring of those lands receiving reclaimed water. This impact could affect the existing tax rate structure. Direct costs are calculated to be $500 per sample set x 2 sample sets per year, $1,000 per year. This activity would be in competition with other activities and services for limited funds.

Staffing adjustments would be necessary for agencies involved in implementing spray regulations for non-agricultural uses.

ECONOMIC IMPACTS

Use or non-use of reclaimed water could increase or decrease agricultural productivity of the land. Employment patterns could be affected if monitoring of use of reclaimed water indicates use is detrimental.

Curtailment of use of reclaimed water due to monitoring and sampling could lessen economic viability of the land and escalate consumer costs if the fodder source was eliminated.

Availability of fodder produced locally is a cost saving for the farmer.

Curtailment of reclaimed water use would result in higher feed costs which would be passed on to the consumer.

Utilization of reclaimed water on agricultural lands could increase the property values.

Spraying regulations could create economic hardships on manufacturers of pesticides and herbicides.

Implementation of spray regulatory programs and public education programs would be a public cost.

SOCIAL IMPACTS

Utilization of lands for fodder production removes certain lands from possible housing development. Curtailment of wastewater irrigation could make available more lands for development. If monitoring of lands receiving wastewater shows no detrimental affects, this reduction in potential lands for housing could raise cost of housing.

Fodder production utilizing wastewater irrigation can contribute to community green belting and create a sense of community.

Regulation of uses of household pesticides and herbicides could result in reduction of spraying accidents.

A-6 LITTER AND SOLID WASTE CONTROL

The objective of this action is to establish uniform ordinances which would keep contaminants from entering receiving waters.

ENVIRONMENTAL IMPACTS

Air quality would be enhanced as instances of odorous conditions decreased. Reduction in littering could result in reduction in vehicular emissions from litter collection equipment.

A benefit could be energy savings in reducing fuel consumption as a result of reductions in litter collection.

An impact could be enhancement of water quality which would promote multiple uses of receiving waters, i.e., boating, swimming, fishing, etc. Improvement in water quality could enhance fish and wildlife habitats, contribute to improved groundwater quality.

Effective litter control could impact existing solid waste disposal sites with increased activities but possibly fewer individual trips.

The elimination of litter in streams, along creek banks and on the roadsides would contribute to increased visual amenities and preservation of environmental and scenic resources.

INSTITUTIONAL AND FINANCIAL

This control measure will result in direct public costs of $2,500 which have been estimated for reviewing model ordinances and drafting local ordinances. Costs will have a minor impact on property taxes. It is envisioned that ABAG will have a major role in this activity; the regional body will draft and make available a model ordinance for the counties and cities to use as a basis for local ordinances. Funding for ABAG's activity could be by an E.P.A. 75% grant, ABAG picking up the remaining 25%.

Accomplishment of litter control ordinances by Sonoma County and Sonoma and Petaluma could require staff time. Administration and enforcement of litter ordinances could necessitate augmenting staffs of agencies having these responsibilities.

ECONOMIC IMPACTS

A possible impact of this control measure could be a shift in production techniques or modifying packaging methods.

An impact of this control measure could be additional employment in the production of goods and services. This could result in an increase in production costs which would in turn be passed on to the consumer.

A cleaner environment could result in a minor increase in property values. Improved visual conditions as a result of effective litter control could make a community business district a more desirable shopping area.

SOCIAL IMPACTS

In areas where litter ordinances are in force, improved visual characteristics could increase an area's sense of community.

Litter control programs could be conducive to the control of vectors and other noxious species. Additionally, a cleaner environment could contribute to increasing civic pride and community involvement.

B-12 DRAINAGE ORDINANCE

ENVIRONMENTAL IMPACTS

Protection of the riparian zones could enhance the beneficial uses of water bodies for fishing, swimming and other water oriented activities. A direct benefit would be the retention and maintenance of fish and wildlife habitats in stream bottoms and in the riparian edges.

The creek corridor zones could act as a filter strip to reduce contaminant loadings in the receiving waters. Retention of undisturbed riparian vegetation could contribute to the generation of additional wildlife habitats.

A benefit from an enforced drainage ordinance would be the retention of the natural state of the environment and scenic resources.

INSTITUTIONAL AND FINANCIAL IMPACTS

Drafting and adopting a drainage ordinance will have impacts on the staffs of those agencies and departments involved.

Accomplishment of the ordinance, review sessions, and the public hearing process will have costs estimated at $2,500 for the responsible departments or agencies. Implementing the control measure could create fiscal impacts on the responsible departments or agencies.

Retention of creekside vegetation in the setback zone could help prevent erosion and save both public and private costs for erosion repair.

ECONOMIC IMPACTS

Lands previously considered developable for housing, industry, or agriculture, might be included in creek setback zone, thus removing its economic potential.

An adopted and implemented ordinance could result in an increase in property values on adjacent lands contiguous to creeks and drainageways. Consequently, increased values could be passed on to the consumer in the form of increased property costs.

The prohibition of uses of certain lands along creeks and drainageways could reduce agricultural productivity and increase consumer costs for products in short supply and reduce sediment transport to lower reaches.

SOCIAL IMPACTS

Reduction in housing supply could force housing costs upward.

Setback requirements could reduce or eliminate the likelihood of structural problems associated with slope instability, thus promoting public health and safety.

Retention of riparian zones could have a direct bearing on community development patterns. On the other hand, protection of riparian vegetation could create hazardous fire conditions.

Retention of creekside vegetation could create a sense of community, increase neighborhood cohesiveness and public awareness of values of riparian zones.

INITIAL PHASING IMPLEMENTATION SCHEDULE

The Initial Phasing Implementation Table provides an overview of the timing of anticipated SRMP actions as they relate to other control measures during the Initial Phasing period (1978-1980). The table is an abbreviated graphic representation of the plan summary - Table A, with the general time frame for each activity on a yearly basis.

TABLE C

INITIAL PHASING IMPLEMENTATION SCHEDULE

CONTROL MEASURE	YEAR 1 July 78	Dec	June 79	YEAR 2 July 79	Dec	June 80
S-1 PROGRAM ADMINISTRATION						
Action S-1.1 Create surface runoff quality committee (SRQC)						
Action S-1.2 Ord. review						
Action S-1.3 Documentation of past & existing problems						
Action S-1.4 Backup storm runoff monitoring						
Action S-1.5 Draft erosion control ordinance						
Action S-1.6 Adopt erosion control ordinance						
Action S-1.7 Encourage co-operation & coordination						
Action S-1.8 Establish resource recycling subcommittee of SRQC						
Action S-1.9 Public Works activities						
S-2 EDUCATIONAL PROGRAMS						
Action S-2.1 Land management values						
Action S-2.2 News media alert						
Action S-2.3 Spray research						
Action S-2.4 Ground disturbance						
Action S-2.5 Fire damage						
Action S-2.6 Septic system maintenance						
Action S-2.7 Best management practices manual						

TABLE C - INITIAL PHASING IMPLEMENTATION SCHEDULE - continued

CONTROL MEASURE	YEAR 1 July 78 – Dec	Dec – June 79	YEAR 2 July 79 – Dec	Dec – June 80
A-2 IMPROVE STREET SWEEPING				
Action A-2.1 Document existing & past problems, verify sweeping schedules, County street sweeping policy to be established				
Action A-2.2 Modify activity				
Action A-2.3 Impose parking restrictions				
Action A-2.4 Initiate sweeping program				
Action A-2.5 Policy to establish rural street drainage sediment control standards				
A-4 CONTROL USE OF CHEMICALS & RECLAIMED WATERS				
Action A-4.1 Monitor pollutant buildup from use of reclaimed waters				
Action A-4.2 Spray regulation				
A-6 LITTER & SOLID WASTE CONTROL				
Action A-6.1 Litter control ordinances				
B-12 DRAINAGE ORDINANCE				
Action B-12.1 Drainage ordinance				

SEQUENCE OF ACTIVITIES

The Sequence of Activities tables which follow identify precise activities and their time schedules during the initial planning period. The tables iterate step by step procedures for implementation of control measures designated in the initial plan summary tables. Information given in this table includes names of the agencies or governmental bodies to be involved in the activity, the funding requirements, the ordinances required, the legislative activities necessary to ensure inter-jurisdictional implementation, the enforcement mechanisms and the personnel skills and equipment needed to implement the control measure.

Time for these procedural steps is shown incrementally by months, starting in July 1978 and terminating in June of 1980.

TABLE D
SEQUENCE OF ACTIVITIES

CONTROL MEASURE: PROGRAM ADMINISTRATION	1978						1979												1980					
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
1) Select lead agency for local implementation, recruit & hire coordinator	X																							
2) Request Board of Supervisors & Son. & Petaluma city councils to execute joint powers agreement to create Surface Runoff Quality Committee (SRQC)	X																							
3) Surface Runoff Quality Committee is created		X	X																					
4) Committee oversees public works activities to insure best management practices re erosion			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5) Committee reviews all existing ordinances re water quality & evaluates their effectiveness				X	X	X	X	X	X	X	X	X												
6) Documentation of existing & past surface runoff problems					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
7) With Board of Supervisors & City Council support SRQC establishes subcommittee to study feasibility of recycling sites, litter control ordinances & recycling household chemicals					X	X	X	X	X	X	X	X												
8) Lead agency establishes backup storm runoff monitoring unit						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9) Ensure cooperation & coordination between agencies responsible for maintenance of water quality						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
10) Lead agency with appropriate staff input drafts erosion control ord.									X	X	X	X	X	X	X									
11) Committees to prepare & submit annual rept. to jurisdictions & regional water quality control bd.											X	X											X	X
12) Appointed citizens committee reviews ordinance proposal & makes recommendations back to staff															X	X								
13) Erosion control ordinance is adopted by cities & county																	X	X	X	X	X	X	X	X
14) Committee to accomplish a work program for FY 1981/82 of the continuing planning phase																						X	X	X

TABLE D

SEQUENCE OF ACTIVITIES

CONTROL MEASURE: EDUCATIONAL PROGRAMS	1978						1979												1980				
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M
1. Establish regional education task force to evaluate existing public education programs dealing with environmental management.	X	X	X	X																			
2. Identify educational program needs at a regional level stressing the importance of good land management values.				X	X	X																	
3. Task force drafts criteria and determines scope of regional program. Determines whether to design program "in house" or utilize consultants.							X	X															
4. ABAG determines costs (personnel, equipment, materials, etc.) necessary to support the regional program.									X	X													
5. ABAG and task force investigate potential sources of funding for regional program, i.e. State, Federal, or foundation funding.											X												
6. ABAG staff submits funding request to ABAG general assembly for approval and inclusion in budget.												X											
7. Educational Coordinator and support personnel are hired by ABAG.													X										
8. Programs are defined and produced by task force, ABAG and/or consultants.														X	X	X	X						
9. Program is initiated.																		X	X	X	X	X	X
10. Conduct yearly evaluation of program.																						X	X
11. News media as public service activities will introduce programs which will alert public of existing runoff problems.						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
12. Request the Board of Supervisors and Petaluma and Sonoma City Councils to authorize local educational programs re: land management practices.				X																			
13. Determine cost (personnel and materials) of conducting local programs.					X	X																	
14. Submit funding request to Board of Supervisors and city councils for approval and inclusion in budget.							X	X															
15. Design and produce educational material for public distribution.									X	X													
16. Initiate program and monitor activity.										X	X	X	X	X	X	X	X	X	X	X	X	X	X

TABLE D
SEQUENCE OF ACTIVITIES

CONTROL MEASURE: IMPROVE STREET SWEEPING	1978						1979												1980					
	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
1. Lead Agency continues documenting existing & past problems, verifies existing sweeping schedules.	X	X	X																					
2. Board of Supervisors instructs Co. Public Works to establish street sweeping policy in urbanized unincorporated areas.		X																						
3. Co. Public Works Dept. establishes sweeping policy.			X																					
4. Co. Public Works Dept. determines cost for personnel, equipment and training.			X																					
5. Submit funding request for County program to Board of Supervisors for approval and inclusion in budget.				X																				
6. Cities of Petaluma and Sonoma modify their street sweeping schedules to concentrate activities prior to rainy season.				X																				
7. Request that City Council of Sonoma create parking restrictions in the street sweeping areas.	X																							
8. Determine cost for personnel and materials, i.e. new signs.		X																						
9. Request approval of funding for fabrication and installation of signs.		X																						
10. City of Sonoma enacts parking restrictions.			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11. County of Sonoma Public Works Dept. acquires equipment, hires and trains personnel.													X	X										
12. County of Sonoma Public Works Dept. creates a sweeping schedule.													X	X										
13. County of Sonoma Public Works Dept. initiates street sweeping program.														X	X	X	X	X	X	X	X	X	X	X
14. Board of Supervisors instructs Public Works and Community Develop. & Environmental Services Dept. to establish rural street drainage and sediment standards.															X	X								
15. Rural street drainage and sediment standards adopted.																	X	X	X	X	X	X	X	X

TABLE D
SEQUENCE OF ACTIVITIES

	CONTROL MEASURE: CONTROL USE OF CHEMICALS & RECLAIMED WATERS	1978						1979												1980					
		J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
1.	Request Board of Supervisors and City Council of Petaluma to instruct their respective sanitation districts to monitor pollutant loading in areas receiving reclaimed waters and make info available to users.											■	■												
2.	County sanitation districts and Petaluma Sanitation Dept. initiate monitoring program.													■	■	■	■	■	■	■	■	■	■	■	■
3.	Monitoring results are published annually for public distribution.																							■	■
4.	Request Board of Supervisors and city councils to encourage state-wide control of herbicides and pesticides used in non-agricultural activities.																■								

TABLE D
SEQUENCE OF ACTIVITIES

	CONTROL MEASURE: LITTER & SOLID WASTE CONTROL	1978						1979												1980					
		J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
1.	S.R.Q.C. requests Board of Supervisors and city councils to instruct their appropriate depts. to investigate feasibility of adopting litter ordinances.		■																						
2.	ABAG furnishes model ordinances for cities and County's review and possible use.			■																					
3.	Cities and County draft litter control ordinances.				■																				
4.	Cities and County hold public hearings and adopt ordinances.					■	■																		
5.	Enact ordinances and monitor							■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

TABLE D
SEQUENCE OF ACTIVITIES

CONTROL MEASURE:	1978						1979												1980					
DRAINAGE ORDINANCE	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
1. S.R.Q.C. requests the Board of Supervisors and city councils to instruct their appropriate depts. to draft drainage ordinances.			█																					
2. Board of Supervisors and city councils instruct depts. to draft drainage ordinances.				█																				
3. Ordinances are drafted by cities and County.					█	█																		
4. Draft ordinances are reviewed by agricultural, industrial, construction interests, environmental groups and interested public groups for input.							█	█	█															
5. Board of Supervisors and city councils hold public hearings and adopt drainage ordinances.										█														
6. Enforcement agencies are designated and personnel and equipment costs are articulated to respective executive bodies.										█														
7. Submit funding requests to executive bodies for approval and inclusion in budget.											█													
8. Enact drainage ordinance and monitor effectiveness on an annual basis.												█	█	█	█	█	█	█	█	█	█	█	█	█

APPENDIX

Surveys and Research

Monitoring Program

Modeling Program

Suspected Existing and
Potential Problems

Available Control
Measure Technology

Data Base

SURVEYS AND RESEARCH

Scientific identification of problems caused by surface water pollution in Sonoma County cannot be conclusively applied at this time because of a paucity of data showing an unqualified cause and effect relationship between suspected pollution source and suspected pollution problem. Problem identification has been mostly by unscientific means, from a citizen committee and a technical committee of practitioners in various fields but rarely including anyone of unquestioned expertise. Following are general findings regarding suspected pollution problems and sources in the study area of this plan.

Urban Areas

Sonoma County's urban contribution to the surface runoff (or non-point source, 208 Program) pollution of the San Francisco Bay is small compared to the more densely populated Bay Area counties. The amount of urbanization within Sonoma County which drains to the Bay is only three percent for the Sonoma Basin and four percent for the Petaluma Basin. As more urbanization takes place, the potential for urban origin pollutants will increase in Sonoma County.

Like other cities, the cities of Sonoma and Petaluma have the typical problem of limited funding to keep the streets and storm drain inlets clean. Observations show that people often use street gutters and drain inlets as a means of disposing of litter such as food containers and wrappers, cigarettes and grass clippings.

Some of the older streets in both cities have broken curbs and gutters as well as driveways with ramps extending into the street which makes it very difficult for a street sweeper to clean properly. There are also discontinuities in curbs and gutters; for example, an unimproved lot which does not have a curb or gutter. Discontinuous curbs and gutters in poor condition tend to collect contaminants until a major storm can flush them downstream.

Rural Areas

The rural and unincorporated areas of the two basins have several suspected problems. Those which need surveillance are biochemical oxygen demand and suspended solids. As suspended solids act as a vehicle for transporting contaminants, it is desirable to keep the concentration of suspended solids from man's activities to a minimum. It is difficult to separate natural erosion from man induced erosion; however, tests have shown that exposed soil can contribute several hundred times that of soil with natural ground cover. Some of the common things that were observed within the two basins which are sediment producing, were erosion from new construction, erosion from roadside ditches and banks which have been cleared of vegetation, streambanks and bottoms which erode due to high velocities. Poorly managed grazing land is a suspected source of high concentrations of suspended solids, biochemical oxygen demand as well as increased runoff.

Publications which contain references to water quality matters are listed in the Bibliography. Most of these references are data compilations and contain no original or basic data about surface water pollution. Some contain information on water pollution but not in specific relation to surface water pollution as a cause of suspected environmental problems in receiving waters such as the Bay.

Potential Pollutants and Sources

Surface water runoff pollution constituents from various sources have been separated into categories as follows for ease of definition and description.

a. Nutrients

The source of nutrients is closely related to the sources of organic materials and suspended solids. Many nutrients are released when organic materials are decomposed by micro-organisms. A large contribution of nutrients is from the decay of natural vegetation waste such as leaves and other dead plant materials. Nutrients contributed by human action in the environment include fertilizer and certain other chemicals, domestic animal waste, litter and garbage. The magnitude and percentage of each needs to be determined by monitoring.

b. Organics

Decomposition of organic matter creates biochemical oxygen demand (BOD) in water. BOD is a form of pollution in that the depressed oxygen level may be an unsafe or unlivable environment for aquatic organisms. Under certain runoff conditions, such as the first flush of the first seasonal storm, the dissolved oxygen (DO) can be completely depleted. Then there is no oxygen in the water to support life.

c. Solids

Solids include all inorganic matter both suspended and dissolved. The solids concentration in water is a gross indicator of the pollution level. This is a well documented relationship consistently found when the water is tested for pollution constituents. The solids are the transport medium to which other pollutants such as pesticides, nutrients and heavy metals attach and are carried to the point where the solids settle or come to rest.

d. Metals

Copper, cadmium, chromium, lead, mercury, zinc, and silver are some of the metals which may be water pollutants. Some of the heavy metals are very toxic even in quite low concentrations. Metals may enter surface water from mine tailings, corrosion of machinery and equipment and from autos and trucks via street drainage.

Where do pollutants originate?

Pollutants originate from a wide range of sources but are generally concentrated in higher human activity areas. Some typical sources are as follows:

Inorganic silts from quarries, building site grading, farming, public projects and natural erosion.

Oil and grease from normal vehicle operation and leaks of vehicle lubricants, antifreeze and hydraulic fluids.

Phosphorus and zinc (oil additives) from oil spills.

Lead from spills, leaks or combustion of leaded fuels.

Asbestos from wear of clutch and brake linings and tires.

Copper, nickel and chromium from wear of metals, metal plating, bearings and other moving parts.

Asphalt and concrete constituents from roadway abrasion.

Iron oxides from welding.

Strontium from road flares and fireworks.

Lead, chromium, copper and nickel from wear of brake linings.

Lead and zinc from tire wear.

The list could go on and on including to some extent materials used in many of the human activities in the environment.

Urban streets collect and concentrate pollutants. Nearly eighty percent of the pollution carrying fine solids are within six inches of the curb and over 95 percent within forty inches of the curb. Conventional street sweeping leaves 85 percent of the fine solids on the street.

MONITORING PROGRAM

The monitoring program included gathering of all necessary equipment including installation of a recording rain gage and arranging for laboratory analysis of the surface water samples.

The monitoring program was designed to yield data which would be used to adjust the Storm Water Management Model (SWMM) to local conditions. Without this input of local data the mathematical model could only operate using national average data which probably would not be representative of this area.

All samples were grab samples, collected, preserved, stored and transported according to Standard Methods and other recognized professional procedures. The frequency of sampling and choice of parameters were flexible. Streamflow was measured at the same time that the samples were collected. Base flow was sampled to provide background readings. Five samples which best represent the storm runoff were transported to Brelje and Race Laboratories to be analyzed.

The demonstration watershed lies northwest of the City of Sonoma and includes the communities of Kenwood, Glen Ellen and Sonoma State Hospital. The area includes mountains, rolling hills and also moderately flat valley land along Sonoma Creek and State Highway 12. The valley floor elevation ranges from 140 to 475 msl while the hills on each side of the valley rise to over 2,500 feet. The demonstration watershed has moderate temperatures and precipitation, the latter occurring almost entirely during the seven month period of October through April. Major storms usually conform to the general Pacific type, lasting from two to three days with moderate rates of rainfall. The summer months are very dry frequently causing high fire hazard. The average annual rainfall ranges from

about 35 inches in the valley to 50 inches near the ridge tops. The hills at higher elevations are covered with brush and timber. The valley has scattered rural residences and vineyards. The gently sloping foothills are largely in vineyard and pasture.

The sampling station was at the Agua Caliente Road bridge. An active USGS gage is located at the sampling site.

At the time of sampling the stream, the flow was only 4 cfs. The event did not represent a typical storm runoff condition because only a portion of the watershed produced runoff. In some areas the ground was so dry there was no significant runoff.

Because of the lengthy dry period preceding the mild storm, there was practically no runoff from open space areas; therefore, sediment, leaves or other visable pollutants were not in the residual flow.

A review of the data collected (see Monitoring Data) shows some parameters are very constant or have a fixed relationship and may not need to be analyzed as often in future monitoring programs.

Monitoring Data

Nutrients - The nitrate plus nitrite tested in the range of 1.3 to 1.7 mg/l. The Kjeldahl nitrogen ranged from 0.50 to 0.60 mg/l. The total phosphorus ranged from 0.24 to 0.30 mg/l.

Organics - The volatile suspended solids ranged from 2-7 mg/l. Because the value for suspended solids was low, the volatile suspended solids standard deviation was high.

Solids - As the sample was from residual flow, the total suspended matter was low (e-7 mg/l). The dissolved solids ranged from 240-250 mg/l.

Metals - The metals were tested from a composite sample.

Lead less than 0.01 mg/l.
Mercury less than 0.001 mg/l.
Cadmium less than 0.003 mg/l.
Silver less than 0.005 mg/l.

Bacteria - Total coliform ranged from 11,000 to 24,000 MPN/100 ml. Fecal coliform fell in the range of 1,500 to 4,600 MPN/100 ml while the fecal strep was greater than 24,000 MPN/100 ml.

Other - The sample for chlorinated hydrocarbons was not taken due to the lack of runoff.

Chemical oxygen demand was tested from a composite sample at 17 mg/l.

There is a need for yearly sampling into the future until reliable data has been accumulated. This data is necessary to making sound decisions as to the real pollution hazards of surface water constituents.

MODELING PROGRAM

Preparation of Data for the Planning Model

ABAG's regional population zones were used to develop an adjusted set of population figures and land use acreage, etc., to fit the Petaluma and Sonoma basins.

For the MAC modeling purposes, the Petaluma Basin was divided into four drainage zones called Penngrove, Petaluma, Petaluma River and San Antonio each with subareas A, B and C. The subarea categories are: A natural and protected; B potentially developable; and C existing urban. The Sonoma Basin was divided into three drainage zones: The Glen Ellen, Sonoma and Bayside. Glen Ellen zone (the demonstration watershed) has two A subareas, one B subarea and three urban areas (Kenwood, Glen Ellen and Eldridge). The Sonoma zone has one C subarea which includes Agua Caliente, Boyes Springs, El Verano and the City of Sonoma. The Bayside zone has no C subareas.

After land use was specified, pollution values in mg/l for each parameter were assigned to each type of land use. These values were local Bay Area averages from the limited test results obtained from monitoring local runoff. Average daily rainfall data was used for each subarea.

Preparation of Land Use Data

The information for the MAC model was prepared by averaging regional population zone data and adjusting it to the Sonoma and Petaluma basins. It appeared that the County's census tract data was a better base to make projections from as they are the basis for the County's General Plan. The County's land use maps were used to develop data for MAC.

Procedures for Measuring or Estimating Watershed Characteristics

USGS quad maps were used for base data to determine slopes. The County's land cover inventory maps show considerable detail on types of land cover as of 1971. From these maps the percentages of total drainage basin coverage for different land types were estimated. Gross runoff coefficients were based on the annual average runoff divided by the annual average rainfall.

The baseline data or local averages were used in the mathematical model to determine the total pollution loadings. The first land use categories and MAC watershed boundaries were set in December of 1976. It was decided that using Sonoma County's "Existing Land Use" maps would give us more confidence in the modeling-at least for base data. The land use maps used have a base year of 1971 and were assumed to be close enough for 1975 use. From this 1975 data base new population and land use acreages were projected for the years 1985 and 2000.

The 1985 and 2000 land use projections were based on adjustments to ABAG's Series 3.

Since Base Case I of Series 3 is the projection that is more widely "accepted" by local agencies, those projections are being used for the analyses of future conditions.

Tables 5 through 10 show the land use acreages in each zone for the years 1975, 1985 and 2000. Those acreages were used in the mathematical model.

Presentation of Mathematical Model (MAC) Results

Several MAC runs were made based on average seasonal rainfall for each basin, such as the 1968-69 rain year and estimated land use acreages for the level of development expected for the three future points in time. The 1968-69 rain year was found to be the most typically average of all the years of record and was used because it would produce the most nearly average result. The following tables show the concentrations of pollution in milligrams per liter per acre and the "K"-Factors used in the MAC model.

Tables 11 through 14 summarize the annual pollutant loads using the MAC model. Tables 15 through 18 list pollutant loads by subareas (areas are shown on basin maps, figures 1 and 2). Tables which have "SCWA" after the land use year were based on the acreages from the County's 1971 land use maps. Even though some of the land use areas differed considerably within the subareas, the total loadings were within the expected accuracy of the model.

Analysis of Future Water Quality Problems

a. Relationship of Surface Runoff Loads to Point Source loads

Figures 3 through 6 and 11 through 14 are bar graphs showing non-point versus point source pollutant loads per basin. These figures are based on 180-days for point source and number of rainy days in the 1968 season for non-point source.

b. Ranking of Importance of Source Areas

Tables 19 through 22 show the ranking of pollutant loads for both basins combined and for each of the land use years, 1975, 1985 and 2000.

It should be noted that according to MAC output development does not necessarily increase the total loading of all the pollution parameters. Figure 4 shows that the total loading of suspended solids does not increase with more development but decreases slightly. From the bar graphs it can be seen that the pollution contribution to the San Pablo Bay from development (residential, commercial and industrial) is quite low relative to the pollution from open land. This seems reasonable since urbanization in the Sonoma and Petaluma basins is only three and four percent respectively.

TABLE 1

MAC QUALITY CONCENTRATIONS (average) MG/L/AC
BASIN "SONOMA"

	BOD	SS	VSS	TOT N	TOT P
Single Family Residential	15	200	25% of SS 50	3.5	.4
Multi-Family Residential	-	-	-	-	-
Commercial	20	150	70	5	.7
Industrial	13	120	50	3	.5
Open Space	4	500	15% of SS 75	2	.3
Agricultural					

TABLE 2

MAC QUALITY CONCENTRATIONS (average) MG/L/AC
BASIN "PETALUMA"

	BOD	SS	VSS	TOT N	TOT P
Single Family Residential	15	200	25% of SS 50	3.5	.4
Multi-Family Residential	-	-	-	-	-
Commercial	20	150	70	5	.7
Industrial	13	120	50	3	.5
Open Space	4	350	15% of SS 53	2	.3
Agricultural					

TABLE 3

MAC "K-FACTORS" 1968-69 RAINFALL
BASIN "PETALUMA"

	K-FACTOR
Single Family Residential	.41
Multi-Family Residential	.41
Commercial	.80
Industrial	.60
Open Space	.17

TABLE 4

MAC "K-FACTORS" 1968-69 RAINFALL
BASIN "SONOMA"

	K-FACTOR
Single Family Residential	.42
Multi-Family Residential	.42
Commercial*	.80
Industrial**	.60
Open Space	.21

*In Sub-area "C" of Glen Ellen sub-watershed change K-factor of commercial from .80 to .21 because of Sonoma State Hospital.

**In Sub-area "A" of Bayside sub-watershed change K-factor of industry from .60 to .41 because of naval reserve base.

TABLE 5 - SONOMA BASIN LAND USE - 1975
(in acres)

MAC WATERSHED	SUB-AREA	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	OPEN
Glen Ellen (SN 1)	A	88	12	6	23,921
	B	148	36	8	12,706
	C	296	92	13	540
		532	140	27	37,207
Sonoma (SN 2)	A	2	0	0	14,611
	B	767	240	38	17,825
	C	997	310	42	534
		1,766	550	80	32,970
Bayside (SN 3)	A	458	142	19	18,745
	B	54	17	2	17,058
		512	159	21	35,803
TOTAL		2,810	849	128	105,980

TABLE 6 - SONOMA BASIN LAND USE - 1985
(in acres)

MAC WATERSHED	SUB-AREA	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	OPEN
Glen Ellen (SN 1)	A	249	6	17	23,754
	B	596	91	18	12,194
	C	410	71	10	450
		1,255	168	45	36,398
Sonoma (SN 2)	A	2	0	0	14,611
	B	2,357	405	63	16,050
	C	1,538	267	36	41
		3,897	672	99	30,702
Bayside (SN 3)	A	308	53	1	17,070
	B	51	9	7	18,996
		359	62	8	36,066
TOTAL		5,511	902	152	103,166

TABLE 7 - SONOMA BASIN LAND USE - 2000
(in acres)

MAC WATERSHED	SUB-AREA	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	OPEN
Glen Ellen (SN 1)	A	420	8	17	23,592
	B	1,141	92	18	11,648
	C	801	72	10	59
		2,362	172	45	35,289
Sonoma (SN 2)	A	2	0	0	14,611
	B	5,862	525	81	12,403
	C	1,708	154	20	0
		7,572	679	101	27,014
Bayside (SN 3)	A	601	54	7	18,703
	B	99	9	1	17,021
		700	63	8	35,724
TOTAL		10,634	914	154	98,027

TABLE 8 - PETALUMA BASIN LAND USE - 1975
(in acres)

MAC WATERSHED	SUB-AREA	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	OPEN
Penngrove (SN 4)	A	2	0	0	2,692
	B	710	123	124	15,274
	C	49	11	12	972
		761	134	136	18,938
Petaluma (SN 5)	A	2	0	0	4,015
	B	525	181	138	11,233
	C	1,169	415	303	930
		1,696	596	441	16,178
Petaluma River (SN 6)	A	25	11	13	9,832
	B	48	18	16	20,096
		73	29	29	29,928
San Antonio Marin Side (M 5)	A	6	2	2	8,082
	B	45	9	7	6,457
		51	11	9	14,539
TOTAL		2,581	770	615	79,583

TABLE 9 - PETALUMA BASIN LAND USE - 1985
(in acres)

MAC WATERSHED	SUB-AREA	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	OPEN
Penngrove (SN 4)	A	2	0	0	2,692
	B	1,257	53	83	14,837
	C	129	8	14	894
		1,388	61	97	18,423
Petaluma (SN 5)	A	2	0	0	4,015
	B	2,374	410	387	8,905
	C	1,703	352	272	491
		4,079	762	659	13,411
Petaluma River (SN 6)	A	43	5	9	9,823
	B	90	18	15	20,055
		133	23	24	29,878
San Antonio Marin Side (M 5)	A	2	0	0	8,089
	B	68	1	1	6,448
		70	1	1	14,537
TOTAL		5,670	847	781	76,249

TABLE 10 - PETALUMA BASIN LAND USE - 2000
(in acres)

MAC WATERSHED	SUB-AREA	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	OPEN
Penngrove (SN 4)	A	2	0	0	2,692
	B	2,041	50	117	14,024
	C	202	8	19	816
		2,245	58	136	17,532
Petaluma (SN 5)	A	2	0	0	4,015
	B	3,424	544	521	7,587
	C	2,075	427	316	0
		5,501	971	837	11,602
Petaluma River (SN 6)	A	62	5	12	9,801
	B	120	23	19	20,016
		182	28	31	29,817
San Antonio Marin Side (M 5)	A	10	0	0	8,081
	B	138	1	2	6,378
		148	1	2	14,459
TOTAL		8,076	1,058	1,006	73,410

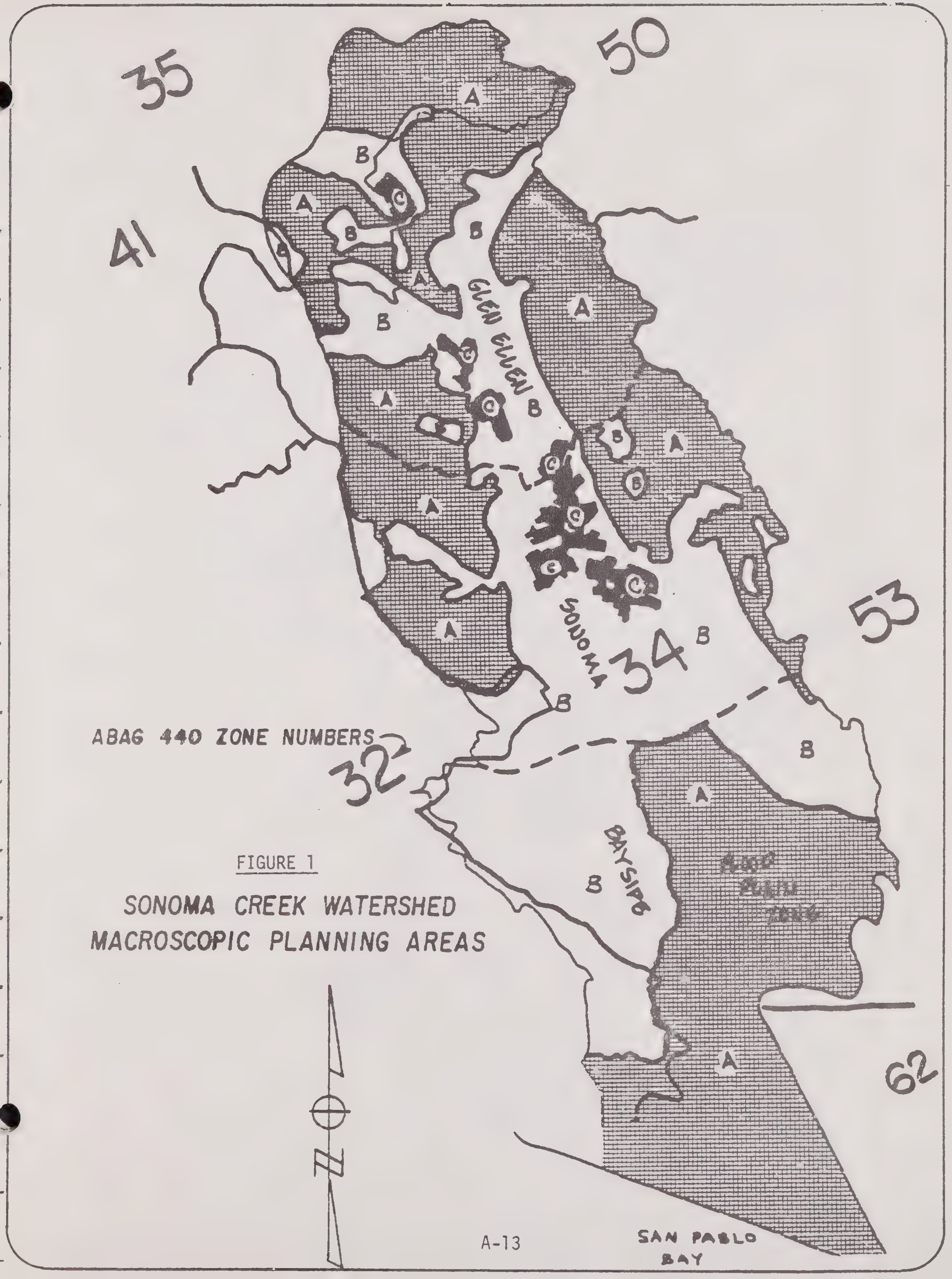


FIGURE 1

SONOMA CREEK WATERSHED
MACROSCOPIC PLANNING AREAS

FIGURE 2

PETALUMA RIVER WATERSHED
MACROSCOPIC PLANNING AREAS

TABLE NO. 11

MAC MODELING DATA - 1975 SONOMA COUNTY PLANNING

MAC WATERSHED NAME	SUB-AREA NAME	AREA (ACRES)	WATERSHED CHARACTERISTICS (cities contained within, predominant land use, topography)	RAINFALL YEAR(S) SIMULATED W/MAC	COUNTY LAND USE YEAR 1975 ANNUAL POLLUTANT LOADS (1,000's of pounds)				
					BOD	SS	VSS	TOT N	TOT P
Sonoma Basin	Glen Ellen	37,751	Kenwood, Glen Ellen, Eldridge, part of Agua Caliente	1968-69	340	37,014	5,640	156	22
	Sonoma	35,365	Sonoma, El Verano Agua Caliente, Boyes Hot Springs	1968-69	414	31,574	5,044	160	22
	Bayside	36,697	Schellville	1968-69	224	21,113	3,306	96	13
Petaluma Basin	Penn-grove	19,848	Penngrove	1968-69	133	7,629	1,251	52	6
	Petaluma	18,158	Petaluma	1968-69	259	8,228	1,600	80	10
	Petaluma River	28,678	Lakeville area	1968-69	128	10,763	1,643	62	9
	San Antonio Marin side	15,400	open	1968-69	69	5,781	885	33	4
Totals:									
Sonoma Basin		109,813		1968-69	978	89,701	13,990	412	57
Petaluma Basin		82,084		1968-69	589	32,401	5,379	227	29
Sonoma County		191,897		1968-69	1,567	122,102	19,369	639	86

TABLE NO. 12

MAC MODELING DATA - 1975 ABAG

MAC WATERSHED NAME	SUB-AREA NAME	AREA (ACRES)	WATERSHED CHARACTERISTICS (cities contained within, predominant land use, topography)	RAINFALL YEAR(S) SIMULATED W/MAC	ABAG LAND USE YEAR 1975 ANNUAL POLLUTANT LOADS (1,000's of pounds)				
					BOD	SS	VSS	TOT N	TOT P
Sonoma Basin	Glen Ellen	37,751	Kenwood, Glen Ellen, Eldridge, part of Agua Caliente	1968-69	335	37,108	5,637	155	21
	Sonoma	35,365	Sonoma, El Verano, Agua Caliente, Boyes Hot Springs	1968-69	413	31,645	5,066	159	22
	Bayside	36,697	Schellville	1968-69	195	20,907	3,194	89	12
Petaluma Basin	Penn-grove	19,848	Penngrove	1968-69	129	7,647	1,243	50	6
	Petaluma	18,158	Petaluma	1968-69	239	8,425	1,587	76	9
	Petaluma River	28,678	Lakeville area	1968-69	134	11,280	1,722	65	9
	San Antonio Marin side	15,400	open	1968-69	65	5,483	836	31	4
Totals:									
Sonoma Basin		109,813		1968-69	943	89,660	13,897	403	55
Petaluma Basin		82,084		1968-69	567	32,835	5,388	222	28
Sonoma County		191,897		1968-69	1,510	122,495	19,285	625	83

TABLE NO. 13

MAC MODELING DATA - 1985 ABAG

MAC WATERSHED NAME	SUB-AREA NAME	AREA (ACRES)	WATERSHED CHARACTERISTICS (cities contained within, predominant land use, topography)	RAINFALL YEAR(S) SIMULATED W/MAC	ABAG LAND USE YEAR 1985 ANNUAL POLLUTANT LOADS (thousands of pounds)				
					BOD	SS	VSS	TOT N	TOT P
Sonoma Basin	Glen Ellen	37,751	Kenwood, Glen Ellen, Eldridge, part of Agua Caliente	1968-69	380	36,982	5,694	164	23
	Sonoma	35,365	Sonoma, El Verano Agua Caliente, Boyes Hot Springs	1968-69	530	31,270	5,206	183	24
	Bayside	36,697	Schellville	1968-69	183	20,920	3,167	86	11
Petaluma Basin	Penn-grove	19,848	Penngrove	1968-69	142	7,704	1,261	53	6
	Petaluma	18,158	Petaluma	1968-69	359	8,889	1,066	101	13
	Petaluma River	28,678	Lakeville area	1968-69	135	11,285	1,724	65	9
	San Antonio Marin side	15,400	open	1968-69	64	5,481	832	31	4
Totals:									
Sonoma Basin		109,813		1968-69	1,093	89,172	14,067	433	58
Petaluma Basin		82,084		1968-69	700	33,359	4,883	250	32
Sonoma County		191,897		1968-69	1,793	122,531	18,950	683	90

TABLE NO. 14

MAC MODELING DATA - 2000 ABAG

MAC WATERSHED NAME	SUB-AREA NAME	AREA (ACRES)	WATERSHED CHARACTERISTICS (cities contained within, predominant land use, topography)	RAINFALL YEAR(S) SIMULATED W/MAC	ABAG LAND USE YEAR 2000 ANNUAL POLLUTANT LOADS (thousands of pounds)				
					BOD	SS	VSS	TOT N	TOT P
Sonoma Basin	Glen Ellen	37,751	Kenwood, Glen Ellen, Eldridge, part of Agua Caliente	1968-69	437	36,766	5,751	176	24
	Sonoma	35,365	Sonoma, El Verano Agua Caliente, Boyes Hot Springs	1968-69	704	30,608	5,375	217	27
	Bayside	36,697	Schellville	1968-69	193	20,881	3,177	89	12
Petaluma Basin	Penn-grove	19,848	Penngrove	1968-69	173	7,829	1,328	59	7
	Petaluma	18,158	Petaluma	1968-69	445	9,217	2,075	119	15
	Petaluma River	28,678	Lakeville area	1968-69	138	11,294	1,729	65	9
	San Antonio Marin side	15,400	open	1968-69	66	5,492	839	31	4
Totals:									
Sonoma Basin		109,813		1968-69	1,334	88,255	14,303	482	63
Petaluma Basin		82,084		1968-69	822	33,832	5,971	274	35
Sonoma County		191,897		1968-69	2,156	122,087	20,274	756	98

TABLE NO. 15

MAC WATERSHED SUB-AREA DATA - 1975 SCWA

Rainfall Data Year 1968-69
Land Use Year 1975-SCWA

MAC WATERSHED SUB-AREA NAMES	SUB-AREAS	POUNDS OF POLLUTANTS (thousands) BOD	SS	VSS	TOT N	TOT P
Glen Ellen SN 1	A	198	23,838	3,592	97	14
	B	110	12,312	1,869	51	7
	C	32	864	179	8	1
Sonoma SN 2	A	107	13,375	2,006	53	8
	B	212	16,715	2,669	84	12
	C	95	1,484	369	23	2
Bayside SN 3	A	145	11,544	1,865	58	8
	B	79	9,569	1,441	38	5
Penngrove SN 4	A	12	1,092	165	6	0
	B	117	6,391	1,058	45	6
	C	4	146	28	1	0
Petaluma SN 5	A	18	1,592	242	9	1
	B	130	5,118	952	44	6
	C	111	1,518	406	27	3
Petaluma River SN 6	A	46	3,680	568	22	3
	B	82	7,083	1,075	40	6
San Antonio Creek, Marin side	A	36	3,161	479	18	2
	B	33	2,620	406	15	2

TABLE NO. 16

MAC WATERSHED SUB-AREA DATA - 1975 ABAG

MAC WATERSHED SUB-AREA NAMES	SUB-AREAS	Rainfall Data Year 1968-69 Land Use Year 1975-ABAG POUNDS OF POLLUTANTS (thousands)				
		BOD	SS	VSS	TOT N	TOT P
Glen Ellen SN 1	A	195	23,637	3,557	95	14
	B	114	12,671	1,926	53	7
	C	26	800	154	7	0
Sonoma SN 2	A	105	13,187	1,978	52	7
	B	205	16,911	2,676	82	12
	C	103	1,547	412	25	3
Bayside SN 3	A	114	11,074	1,713	49	7
	B	81	9,833	1,481	40	5
Penngrove SN 4	A	11	1,009	152	5	0
	B	111	6,235	1,024	43	6
	C	7	403	67	2	0
Petaluma SN 5	A	19	1,671	253	9	1
	B	103	5,196	882	38	5
	C	117	1,558	452	29	3
Petaluma River SN 6	A	44	3,709	567	21	3
	B	90	7,571	1,155	44	6
San Antonio Creek, Marin side	A	35	3,032	460	17	2
	B	30	2,451	376	14	2

TABLE NO. 17

MAC WATERSHED SUB-AREA DATA - 1985 ABAG

MAC WATERSHED SUB-AREA NAMES	SUB-AREAS	Rainfall Data Year 1968-69 Land Use Year 1985-ABAG POUNDS OF POLLUTANTS (thousands) BOD	SS	VSS	TOT N	TOT P
Glen Ellen SN 1	A	203	23,600	3,564	97	14
	B	146	12,589	1,971	59	8
	C	31	793	159	8	1
Sonoma SN 2	A	105	13,187	1,978	52	7
	B	303	16,638	2,808	102	14
	C	122	1,445	420	29	3
Bayside SN 3	A	102	11,087	1,688	47	6
	B	81	9,833	1,479	39	5
Penngrove SN 4	A	11	1,009	152	5	0
	B	121	6,282	1,037	45	6
	C	10	413	72	3	0
Petaluma SN 5	A	19	1,671	253	9	1
	B	211	5,605	1,143	61	8
	C	129	1,613	470	31	4
Petaluma River SN 6	A	44	3,708	566	21	3
	B	91	7,577	1,158	44	6
San Antonio Creek, Marin side	A	34	3,030	458	17	2
	B	30	2,451	374	14	2

TABLE NO. 18

MAC WATERSHED SUB-AREA DATA - 2000 ABAG

MAC WATERSHED SUB-AREA NAMES	SUB-AREAS	Rainfall Data Year 1968-69 Land Use Year 2000-ABAG POUNDS OF POLLUTANTS (thousands)				
		BOD	SS	VSS	TOT N	TOT P
Glen Ellen SN 1	A	212	23,568	3,574	99	14
	B	174	12,482	1,998	65	9
	C	51	716	179	12	1
Sonoma SN 2	A	105	13,187	1,978	52	7
	B	484	16,017	3,010	138	17
	C	115	1,404	387	27	3
Bayside SN 3	A	111	11,054	1,697	49	7
	B	82	9,827	1,480	40	5
Penngrove SN 4	A	11	1,009	152	5	0
	B	149	6,396	1,098	51	7
	C	13	424	78	3	0
Petaluma SN 5	A	19	1,671	253	9	1
	B	272	5,839	1,291	74	9
	C	154	1,707	531	36	4
Petaluma River SN 6	A	45	3,711	567	21	3
	B	93	7,583	1,162	44	6
San Antonio Creek, Marin side	A	34	3,031	459	17	2
	B	32	2,461	380	14	2

SONOMA COUNTY

COMPARISON OF POINT & NON POINT POLLUTION

LOADS FROM MAC WATERSHED

(SONOMA BASIN)

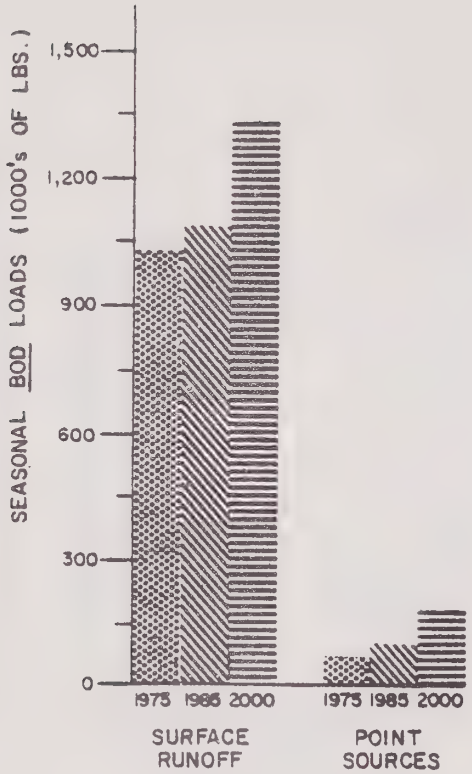


FIGURE NO. 3

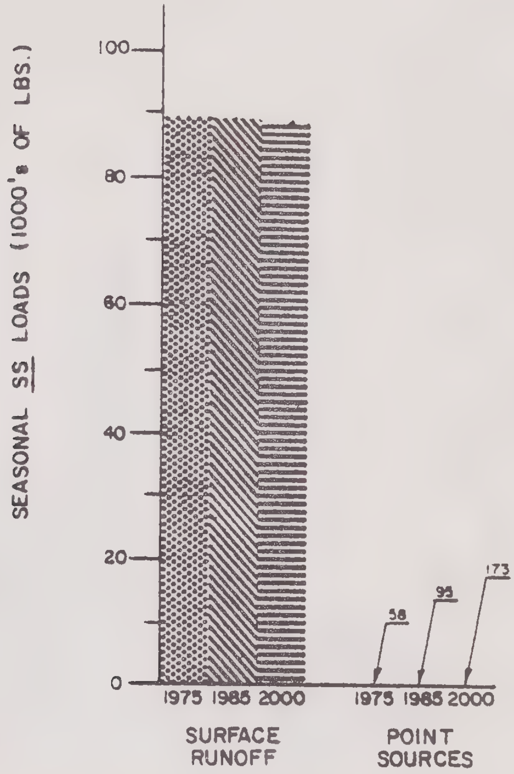


FIGURE NO. 4

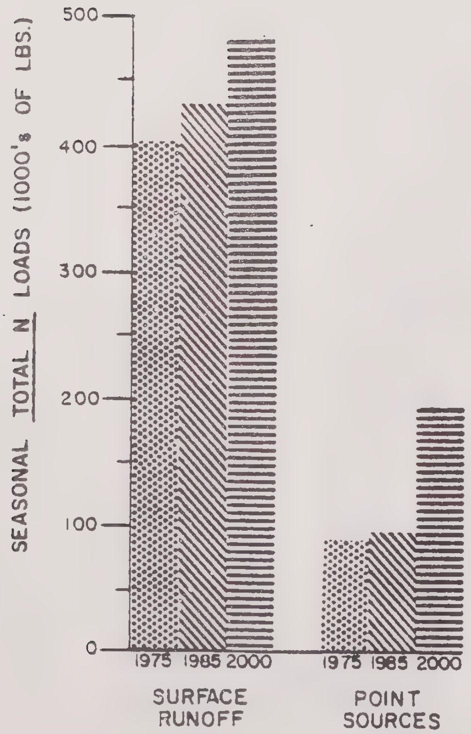


FIGURE NO. 5

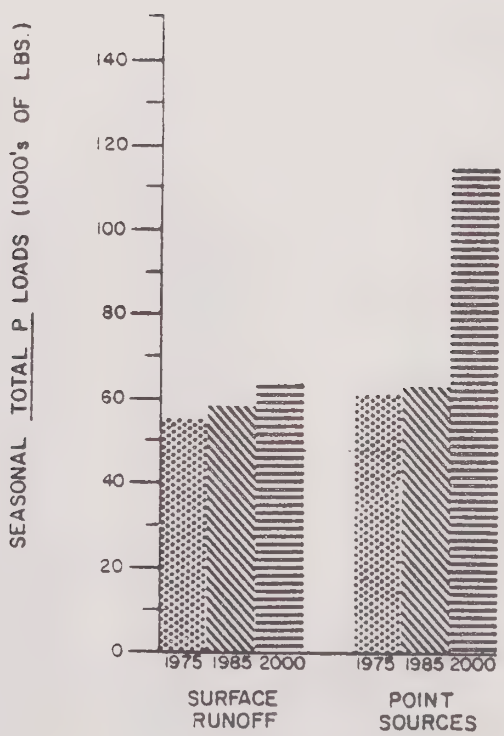


FIGURE NO. 6

SONOMA COUNTY

COMPARISON OF SUB-AREA POLLUTION LOADS FROM

MAC WATERSHED (SONOMA BASIN)

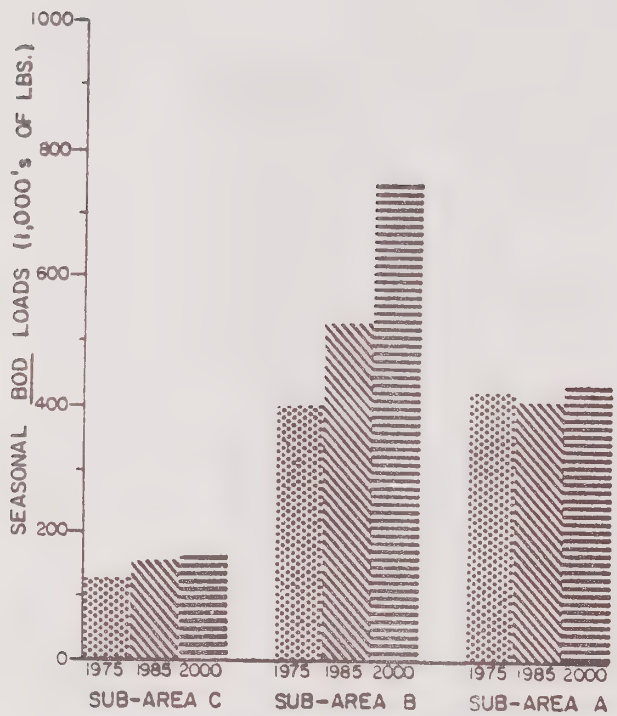


FIGURE NO. 7

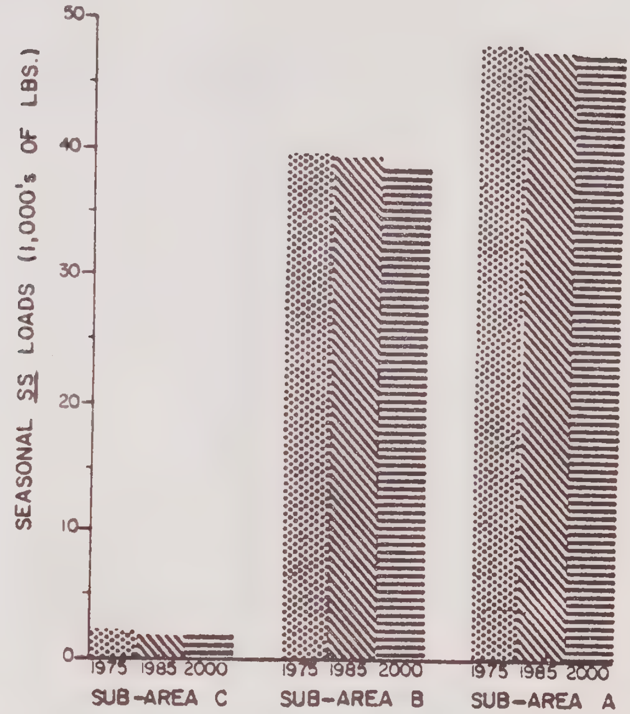
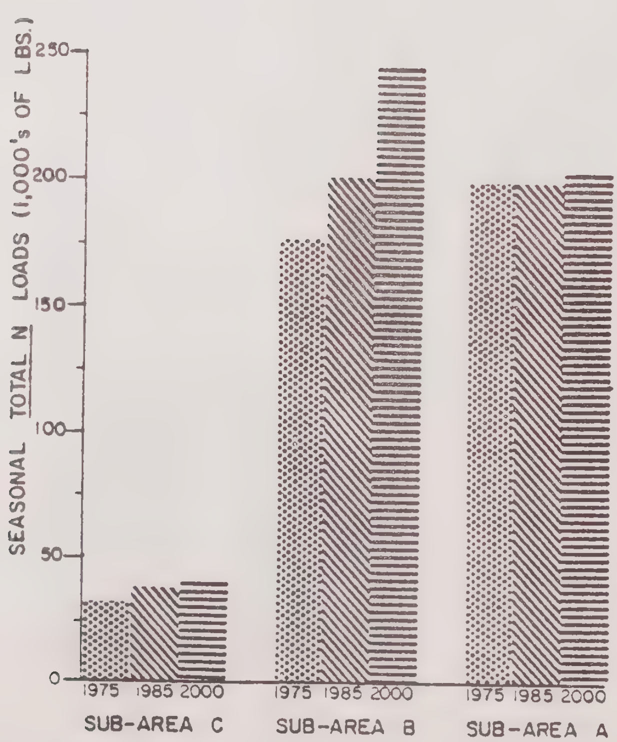


FIGURE NO. 8



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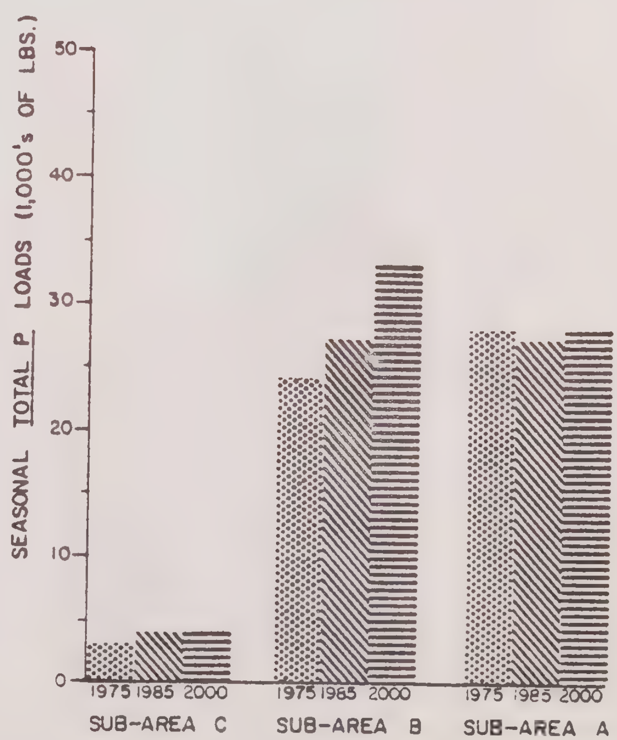


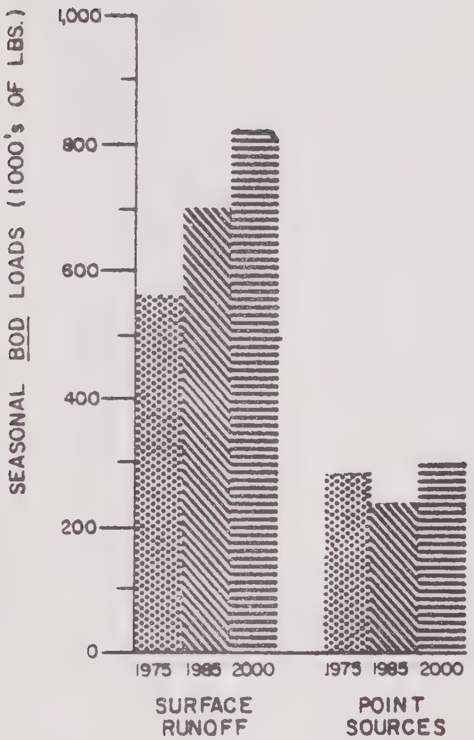
FIGURE NO. 10

SONOMA COUNTY

COMPARISON OF POINT & NON POINT POLLUTION

LOADS FROM MAC WATERSHED

(PETALUMA BASIN)



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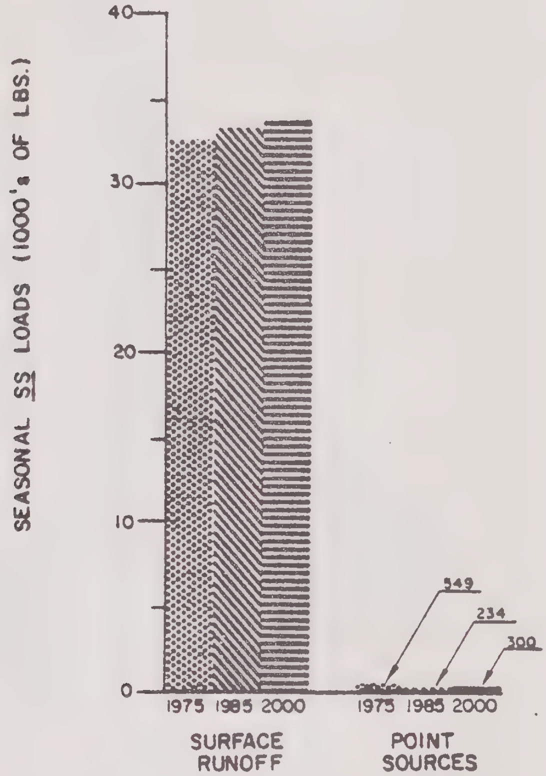


FIGURE NO. 12

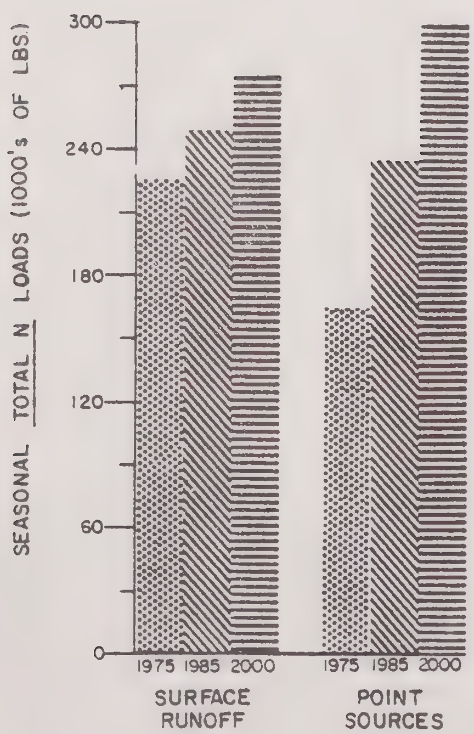


FIGURE NO. 13

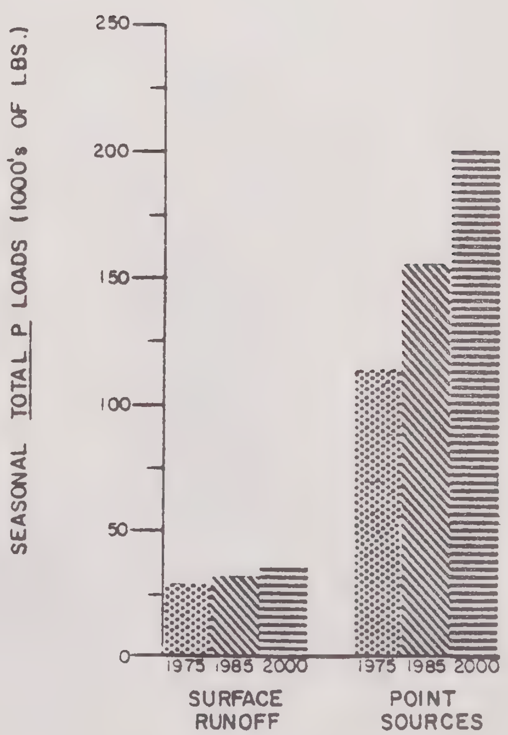


FIGURE NO. 14

SONOMA COUNTY

COMPARISON OF SUB-AREA POLLUTION LOADS FROM

MAC WATERSHED (PETALUMA BASIN)

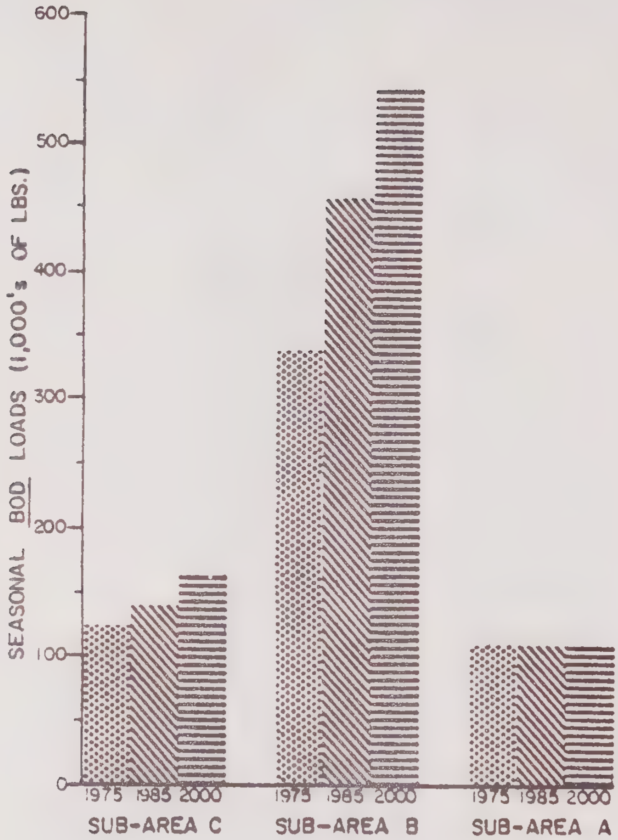


FIGURE NO. 15

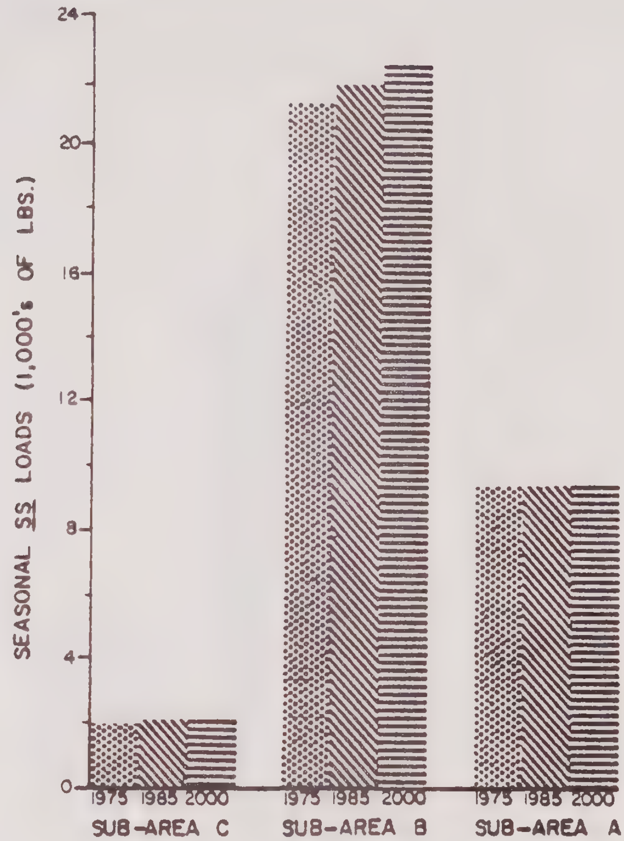


FIGURE NO. 16

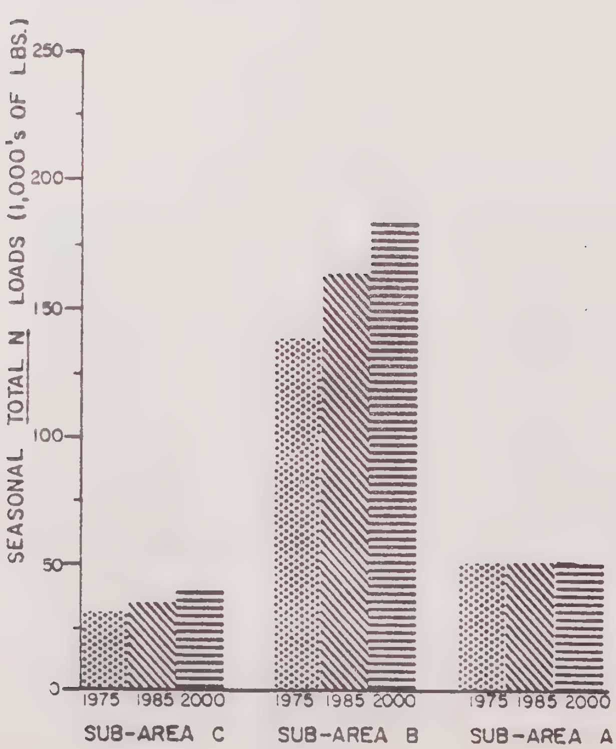


FIGURE NO. 17

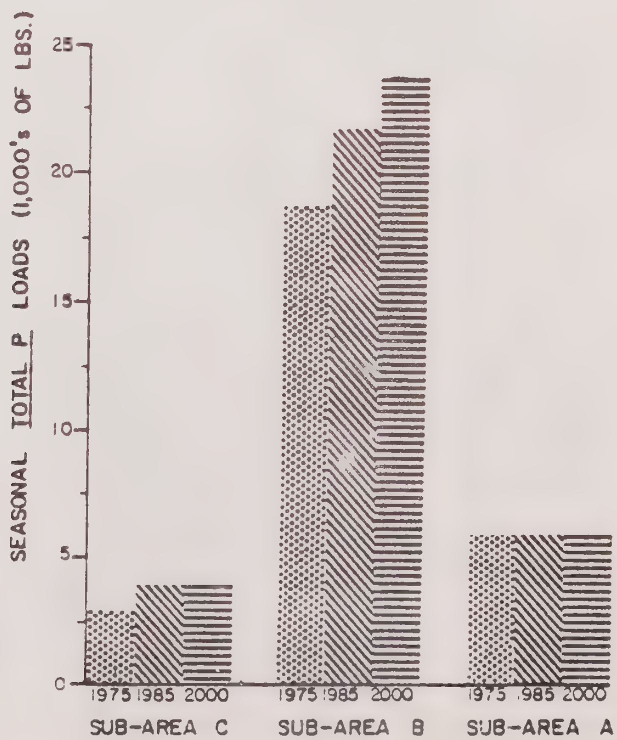


FIGURE NO. 18

TABLE NO. 19

RANKING OF CONTRIBUTION OF SUB-AREAS
TO TOTAL COUNTY POLLUTANT LOADS

RANK	Rainfall Data Year 1968-69 Land Use Year 1975-SCWA									
	BOD		SS		VSS		TOT N		TOT P	
	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed
1	B	SN 2	A	SN 1	A	SN 1	A	SN 1	A	SN 1
2	A	SN 1	B	SN 2	B	SN 2	B	SN 2	B	SN 2
3	A	SN 3	A	SN 2	A	SN 3	A	SN 3	A	SN 2
4	B	SN 5	B	SN 1	B	SN 1	A	SN 4	A	SN 3
5	B	SN 4	A	SN 3	A	SN 3	B	SN 5	B	SN 1
6	C	SN 5	B	SN 3	B	SN 3	B	SN 4	B	SN 4
7	B	SN 1	B	SN 6	B	SN 6	B	SN 5	B	SN 5
8	A	SN 2	B	SN 4	B	SN 4	B	SN 6	B	SN 6
9	C	SN 2	B	SN 5	B	SN 5	B	SN 3	B	SN 3
10	B	SN 6	A	SN 6	A	SN 6	C	SN 5	C	SN 5
11	B	SN 3	A	M 5	A	M 5	A	SN 6	A	SN 6
12	A	SN 6	B	M 5	B	M 5	C	SN 2	C	SN 2
13	A	M 5	C	SN 5	C	SN 5	A	M 5	A	M 5
14	B	M 5	C	SN 2	C	SN 2	B	M 5	B	M 5
15	C	SN 1	A	SN 5	A	SN 5	A	SN 5	A	SN 5
16	A	SN 5	C	SN 1	C	SN 1	C	SN 1	C	SN 1
17	A	SN 4	A	SN 4	A	SN 4	A	SN 4	A	SN 4
18	C	SN 4	C	SN 4	C	SN 4	C	SN 4	C	SN 4

TABLE NO. 20

RANKING OF CONTRIBUTION OF SUB-AREAS
TO TOTAL COUNTY POLLUTANT LOADS

RANK	Rainfall Data Year 1968-69 Land Use Year 1975-ABAG									
	BOD		SS		VSS		TOT N		TOT P	
	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed
1	B	SN 2	A	SN 1	A	SN 1	A	SN 1	A	SN 1
2	A	SN 1	B	SN 2	B	SN 2	B	SN 2	B	SN 2
3	C	SN 5	A	SN 2	A	SN 3	B	SN 1	B	SN 1
4	B	SN 1	B	SN 1	B	SN 1	A	SN 2	A	SN 2
5	A	SN 3	A	SN 3	A	SN 3	A	SN 3	A	SN 3
6	B	SN 4	B	SN 3	B	SN 3	B	SN 6	B	SN 4
7	A	SN 2	B	SN 6	B	SN 6	B	SN 4	B	SN 6
8	C	SN 2	B	SN 4	B	SN 4	B	SN 3	B	SN 3
9	B	SN 5	B	SN 5	B	SN 5	B	SN 5	B	SN 5
10	B	SN 6	A	M 5	A	SN 6	C	SN 5	C	SN 2
11	B	SN 3	A	SN 6	A	M 5	C	SN 2	C	SN 5
12	A	SN 6	B	M 5	C	SN 5	A	SN 6	A	SN 6
13	A	M 5	A	SN 5	C	SN 2	A	M 5	A	M 5
14	B	M 5	C	SN 5	B	M 5	B	M 5	B	M 5
15	C	SN 1	C	SN 2	A	SN 5	A	SN 5	A	SN 5
16	A	SN 5	A	SN 4	C	SN 1	C	SN 1	C	SN 1
17	A	SN 4	C	SN 1	A	SN 4	A	SN 4	A	SN 4
18	C	SN 4	C	SN 4	C	SN 4	C	SN 4	C	SN 4

TABLE NO. 21

RANKING OF CONTRIBUTION OF SUB-AREAS
TO TOTAL COUNTY POLLUTANT LOADS

Rainfall Data Year 1968-69
Land Use Year 1985-ABAG

RANK	BOD		SS		VSS		TOT N		TOT P	
	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed
1	B	SN 2	A	SN 1	A	SN 1	B	SN 2	A	SN 1
2	B	SN 5	B	SN 2	B	SN 2	A	SN 1	B	SN 2
3	A	SN 1	A	SN 2	A	SN 3	B	SN 5	B	SN 1
4	B	SN 1	B	SN 1	B	SN 4	B	SN 1	B	SN 5
5	C	SN 5	A	SN 3	A	SN 3	A	SN 2	A	SN 2
6	C	SN 2	B	SN 3	B	SN 3	A	SN 3	A	SN 3
7	B	SN 4	B	SN 6	B	SN 6	B	SN 4	B	SN 4
8	A	SN 2	B	SN 4	B	SN 5	B	SN 6	B	SN 6
9	A	SN 3	B	SN 5	B	SN 4	B	SN 3	B	SN 3
10	B	SN 6	A	SN 6	A	SN 6	C	SN 5	C	SN 5
11	B	SN 3	A	M 5	C	SN 5	C	SN 2	C	SN 2
12	A	SN 6	B	M 5	A	M 5	A	SN 6	A	SN 6
13	A	M 5	A	SN 5	C	SN 2	A	M 5	A	M 5
14	C	SN 1	C	SN 5	B	M 5	B	M 5	B	M 5
15	B	M 5	C	SN 2	A	SN 5	A	SN 5	C	SN 1
16	A	SN 5	A	SN 4	C	SN 1	C	SN 1	A	SN 5
17	A	SN 4	C	SN 1	A	SN 4	A	SN 4	A	SN 4
18	C	SN 4	C	SN 4	C	SN 4	C	SN 5	C	SN 4

TABLE NO. 22

RANKING OF CONTRIBUTION OF SUB-AREAS
TO TOTAL COUNTY POLLUTANT LOADS

Rainfall Data Year 1968-69
Land Use Year 2000-ABAG

RANK	BOD		SS		VSS		TOT N		TOT P	
	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed	Sub-Area	Water-shed
1	B	SN 2	A	SN 1	A	SN 1	B	SN 2	B	SN 2
2	B	SN 5	B	SN 2	B	SN 2	A	SN 1	A	SN 1
3	A	SN 1	A	SN 2	B	SN 1	B	SN 5	B	SN 1
4	B	SN 1	B	SN 1	A	SN 2	B	SN 1	B	SN 5
5	A	SN 3	A	SN 3	A	SN 3	A	SN 2	A	SN 2
6	B	SN 4	B	SN 3	B	SN 3	B	SN 4	A	SN 3
7	C	SN 2	B	SN 6	B	SN 5	A	SN 3	B	SN 4
8	A	SN 3	B	SN 4	B	SN 6	B	SN 6	B	SN 6
9	A	SN 2	B	SN 5	B	SN 4	B	SN 3	B	SN 3
10	B	SN 6	A	SN 6	A	SN 6	C	SN 5	C	SN 5
11	B	SN 3	A	M 5	C	SN 5	C	SN 2	A	SN 6
12	C	SN 1	B	M 5	A	M 5	A	SN 6	C	SN 2
13	A	SN 6	C	SN 2	C	SN 2	A	M 5	A	M 5
14	A	M 5	C	SN 5	B	M 5	B	M 5	B	M 5
15	B	M 5	A	SN 5	A	SN 5	C	SN 1	C	SN 1
16	A	SN 5	A	SN 4	C	SN 1	A	SN 5	A	SN 5
17	C	SN 4	C	SN 1	A	SN 4	A	SN 4	A	SN 4
18	A	SN 4	C	SN 4	C	SN 4	C	SN 4	C	SN 4

MAC Findings

The following findings address both the Petaluma River and Sonoma Creek Basins and pertain to the five MAC model pollutant parameters; BOD, SS, VSS, N and P.

(1) Surface runoff is indicated to be the major source of water pollution, the majority coming from open land.

(2) Surface runoff pollution loads in the two study basins can be expected to increase significantly by the year 2000 as a result of future development.

(3) Suspended solids loads from the Sonoma and Petaluma Basins total over 60,000 tons/year.

Figures 3-6 show the estimated total pollution load in the Sonoma Basin from Biochemical Oxygen Demand (BOD), Suspended Solids (SS), Total Nitrogen (N), and Total Phosphorus (P) at three points in time (1975, 1985, 2000). These figures also show the estimated point source pollution load for the same years. The same information is shown for the Petaluma Basin on Figures 11-14.

This information indicates that non-point pollution loads (except Phosphorus) may be higher than point source loading.

It should be clearly understood that the above findings are based on MAC input data which was not verified by SWWM output from the demonstration watershed. Therefore, these MAC findings may vary significantly from real world values.

Stormwater Management Model (SWMM)

SWMM enables the user to analyze surface runoff in considerable detail allowing evaluation of the effects of future actions. It is most useful in evaluating the technical differences between alternative land usage and control measures.

Criteria for Selecting the Watershed

SWMM watershed selection was based on the following criteria:

(1) Watershed must be large enough to generate measurable flow during rainfall episodes. Wherever possible, review of historical data would be useful for assessing the expected flow quantity and quality.

(2) Sampling station should have a stream gage or should be such that a gaging station can be readily installed.

(3) Rainfall data should be available within watershed boundary or its close vicinity.

(4) Land use type within the watershed should be fairly uniform; the land use type identified by ABAG should represent at least two-thirds of total watershed area.

(5) Sampling station on the watershed must not be influenced by tidal flow, man-made diversions or obstructions, or backwater curves.

(6) The watershed upstream of the sampling station should not contain point discharges of municipal or industrial waste or major non-point sources of pollutants inconsistent with the overall land use type (e.g., an isolated dairy in a generally suburban watershed).

(7) Sampling station must be easily and quickly accessible during rainy weather. The station should also be such that the samples can be easily collected during storm flows without excessive danger to personnel or equipment.

Preparation of Land Use Data

The County's land use maps were used to determine the amount of various land covers. The demonstration watershed was divided into 43 subcatchments from which the following erosion types were categorized:

a. valley developed
b. valley cultivated
c. valley pasture or open fields
d. hillside cultivated
e. hillside pasture or open fields
f. hillside virgin land (moderate slope)
g. hillside virgin land (steep slope)

Procedures for Measuring or Estimating Watershed Characteristics

The subcatchments were then examined to estimate the ground slope, flow distance and subcatchment width.

The stream characteristics such as length and slope were scaled from U.S.G.S. quad maps while bottom width, side slopes and Mannings' roughness coefficients were estimated by field inspection.

For each of the erosion categories, the soil types from SCS Soil Survey, were characterized by:

a. percent silt and very fine sand
b. percent sand
c. percent organic matter
d. soil structure
e. permeability

From the above information the soil erodibility factor K was estimated for each subcatchment.

The cropping management factor C is dependent upon the ground cover (County's land cover map), the general management practice and the condition of the soil over the area of concern. The land with considerable vegetative cover (virgin, lightly grazed pasture or timbered) has a C of 0.01 to 0.04 for steep slopes. Vineyards were given a value of 0.02 for valley to 0.4 for steep slopes.

Since construction sites constitute a very small fraction of the watershed, the construction site erosion control practice factor P was assumed equal to 0.7 for all subcatchments.

The percent of imperviousness due to roads was estimated by measuring the roads from the topo maps with a map wheel and applying an average road width. The percent of imperviousness due to housing was estimated by eye from existing land use maps.

Selection of Water Quality Coefficients

Due to the lack of significant storm runoff during the 1976-77 rainfall season, no water quality data was developed other than the test results from the residual flow of the January 2nd storm.

SWMM Findings

The SWMM program for Sonoma's demonstration watershed has been calibrated using the limited data available. This resource can be used in the ongoing surface water planning process. It is of limited value now, but as meaningful monitoring data is developed, SWMM is expected to be a useful planning tool.

SURFACE WATER MANAGEMENT MODEL

Demonstration Watershed Description

1. COUNTY: Sonoma County

2. STREAM: Sonoma Creek

3. SAMPLING SITE: 4,241,600 N 544,400 E Coordinates (UTM)

4. STATION NUMBER: 01

5. STREAM DATA:

   a. Baseflow 1-2 cfs

   b. Length 82,000 Ft.

   c. Gradient .0286 Ft./Ft.

   d. Man-made alterations (yes or no)

      (i) Dams Yes (small ag. dams)

      (ii) Diversions No

      (iii) Channelization No

If yes, give specific details on separate sheet

6. PHYSICAL PROPERTIES OF WATERSHED:

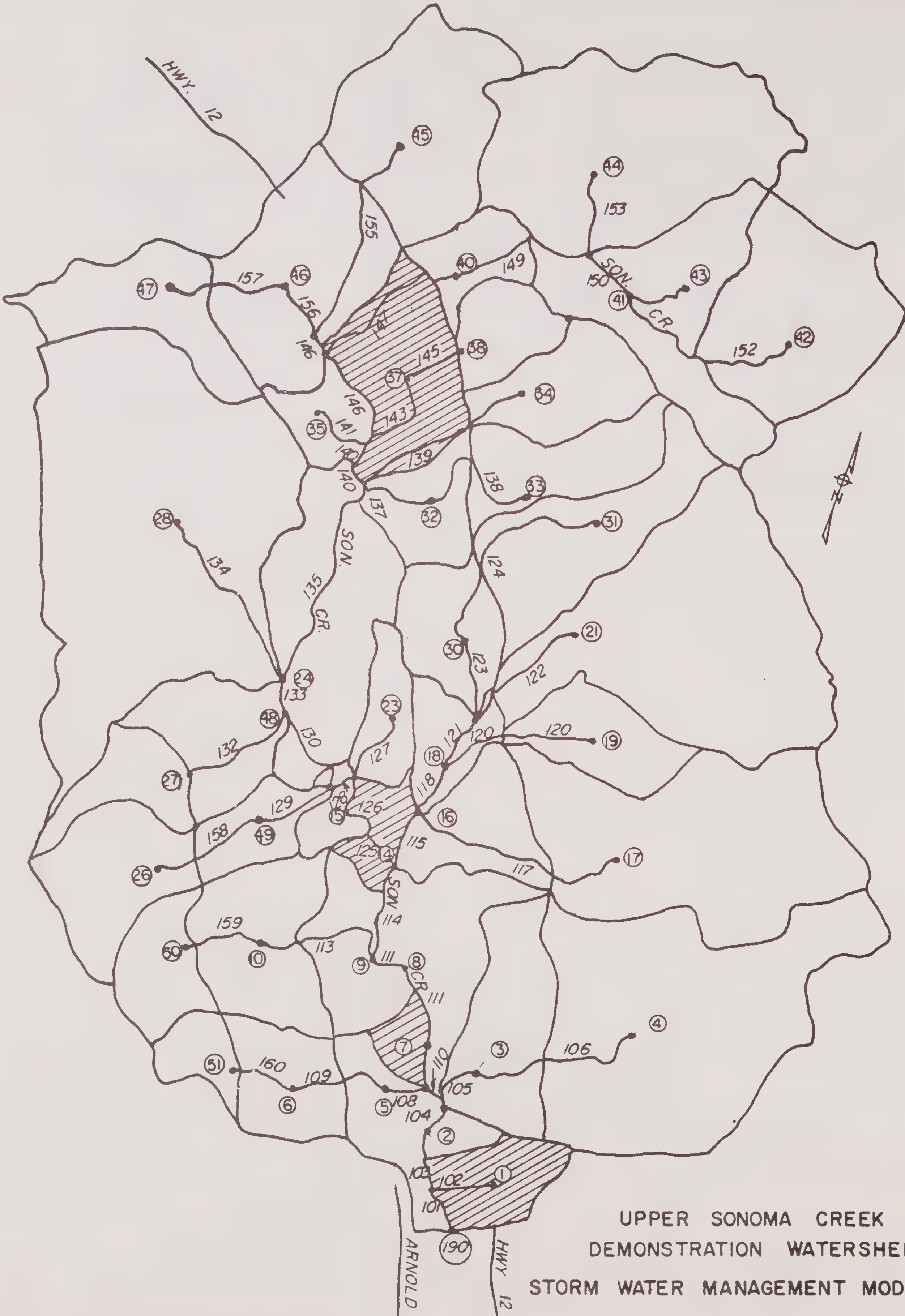
   a. Average Rainfall 41 inches

	TYPE	% OF WATERSHED	ACRES
b. Geology	Younger Alluvium	12%	4420
	Landslides	5%	1732
	Alluvial Fans	6%	2125
	Glen Ellen Formations	13%	4949
	Volcanic Sediments	10%	3541
	Sonoma Volcanics	41%	15236
c. Soils	Goulding	33%	12374
	Rockland	14%	5109
	Spreckles	12%	4553
	Red Hill	12%	4345

The remaining 29% of watershed is made up of 19 other soil types.

7. LAND USE DATA

	ACRES	% OF TOTAL AREA
a. Total Area	37,192	
b. Single Family Residential	739	2
c. Multiple Family Residential	28	.1
d. Commercial	139	.4
e. Industrial	234	.6
f. Open Space	36,032	97
		% OF OPEN SPACE
(i) Forest		
Deciduous	14,561	40
Coniferous	4,109	11
(ii) Brush & Shrub	6,622	18
(iii) Grassland	8,067	22
(iv) Other	2,805	8
		% OF TOTAL AREA
g. Agricultural		8
		% OF AGRI. AREA
(i) Row Crop		0
(ii) Orchard & Vineyard	2,805	8
(iii) Grazing	Same as grassland	



UPPER SONOMA CREEK
DEMONSTRATION WATERSHED
STORM WATER MANAGEMENT MODEL AREAS

SUSPECTED EXISTING AND POTENTIAL PROBLEMS

The problem location maps illustrate areas in the Sonoma and Petaluma Basins which exhibit suspected existing or potential water quality problems. The information was gathered by various agencies (the source is stated on each map). Both sources of surface runoff, i.e., erosion, and problems in receiving waters i.e., sedimentation, are included on these maps. The indicated problems may include point source pollution as the agencies which contributed data have not made the necessary scientific analysis to determine the source of suspected pollution.

E Major
e Moderate
Stream

Erosion: Includes all major forms of water erosion; sheet, gully and streambank.

P

Dairy Waste Disposal: Includes very general areas of intense dairy activities.

S

Sedimentation: Includes deposition of significant quantities of solids in stream channels, reservoirs and flood plains. "Significant" is determined where damage occurs and/or where money is expended for corrective measures.

B

Biological Degradation: Biological degradation would include, but not be limited to the following: fish kills, algae blooms, aquatic weed overgrowth, oxygen depletions and loss of desirable species.

F

Floatables: Included in this group are oil and grease, litter and debris.

B — Bacteria: Water with bacteria counts exceeding standards.

T — Toxic Materials: This category encompasses heavy metals, radionuclides, pesticides and other trace organics.

O — Organics: Include leaves, animal wastes and other materials which are measured as BOD/COD/TOC, etc. These may by evidenced by dissolved oxygen depletions in water.

G — Groundwater Degradation: Locations where the quality of surface runoff threatens to degrade groundwater supplies.

ST — Septic System Failure: Areas with septic tank problems.

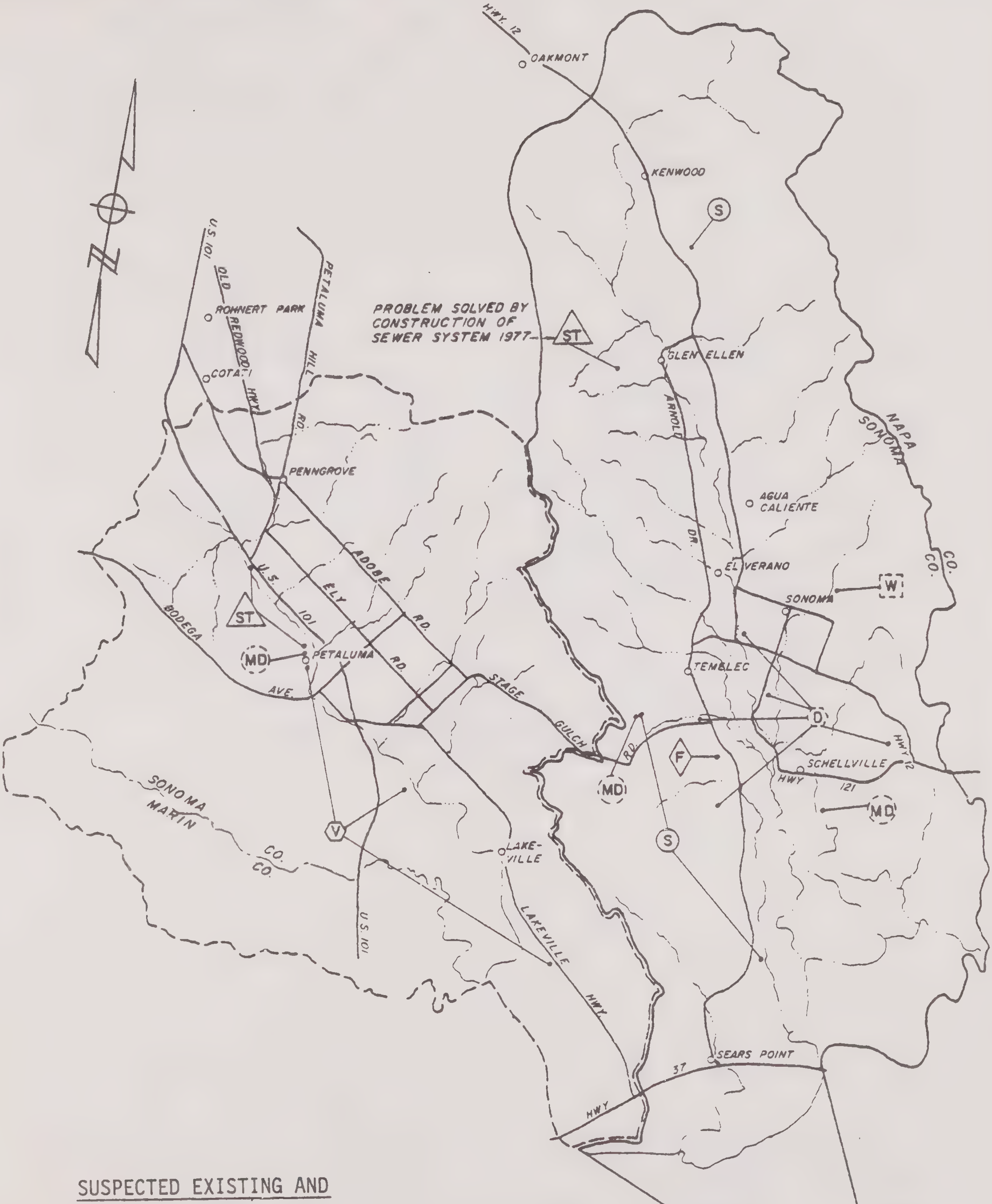
V — Discharge due to Vessel Mooring: fishing, recreational

MD — Miscellaneous Discharge: business districts, storm drains, etc.; treatment plant discharge, public disposal sites

D — Animal Waste Discharge: Poultry waste, manure stockpiles, Note: these types are located throughout watershed (extent unknown)

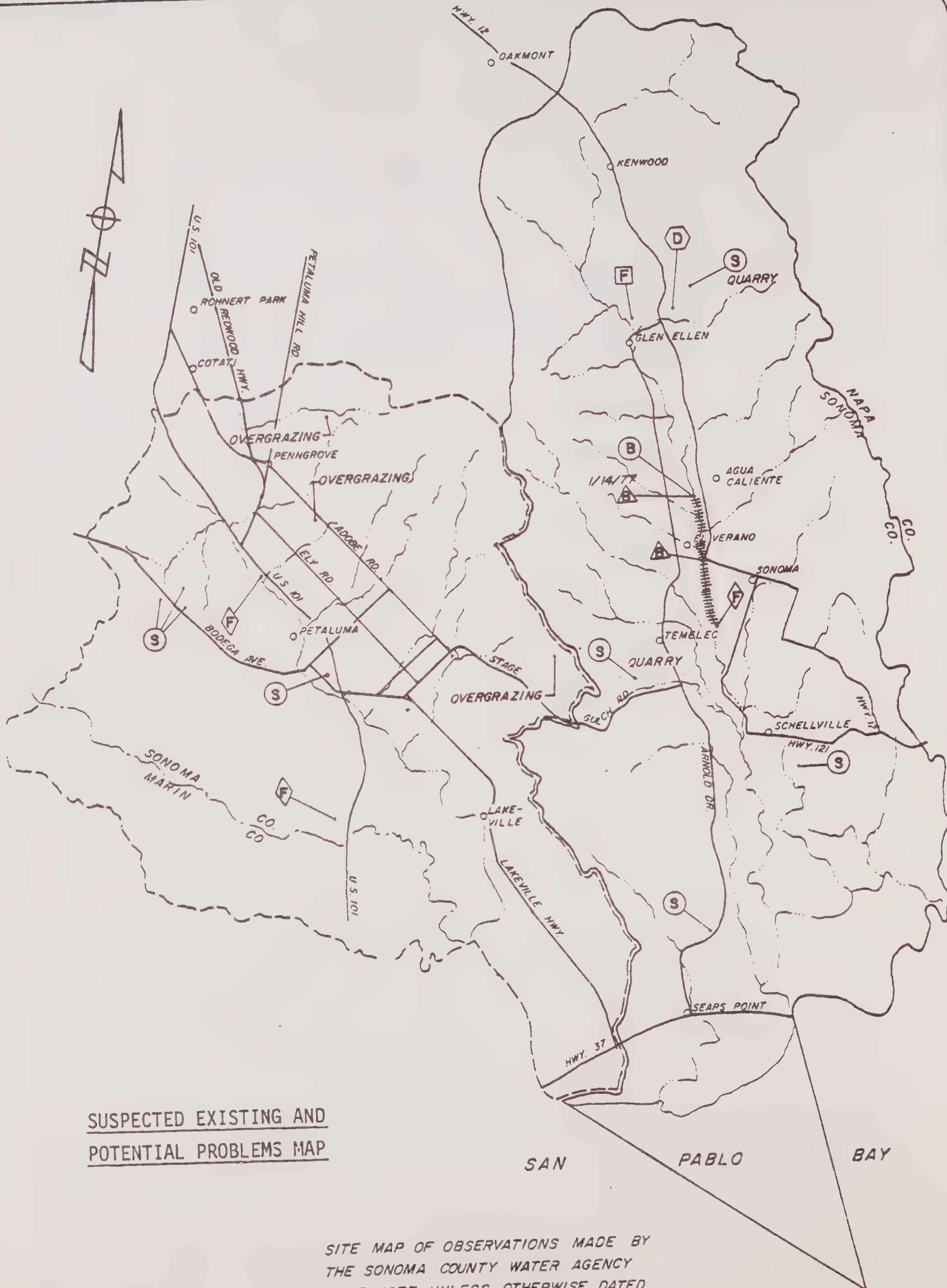
W — Discharge from Wineries

F — Feed Lots



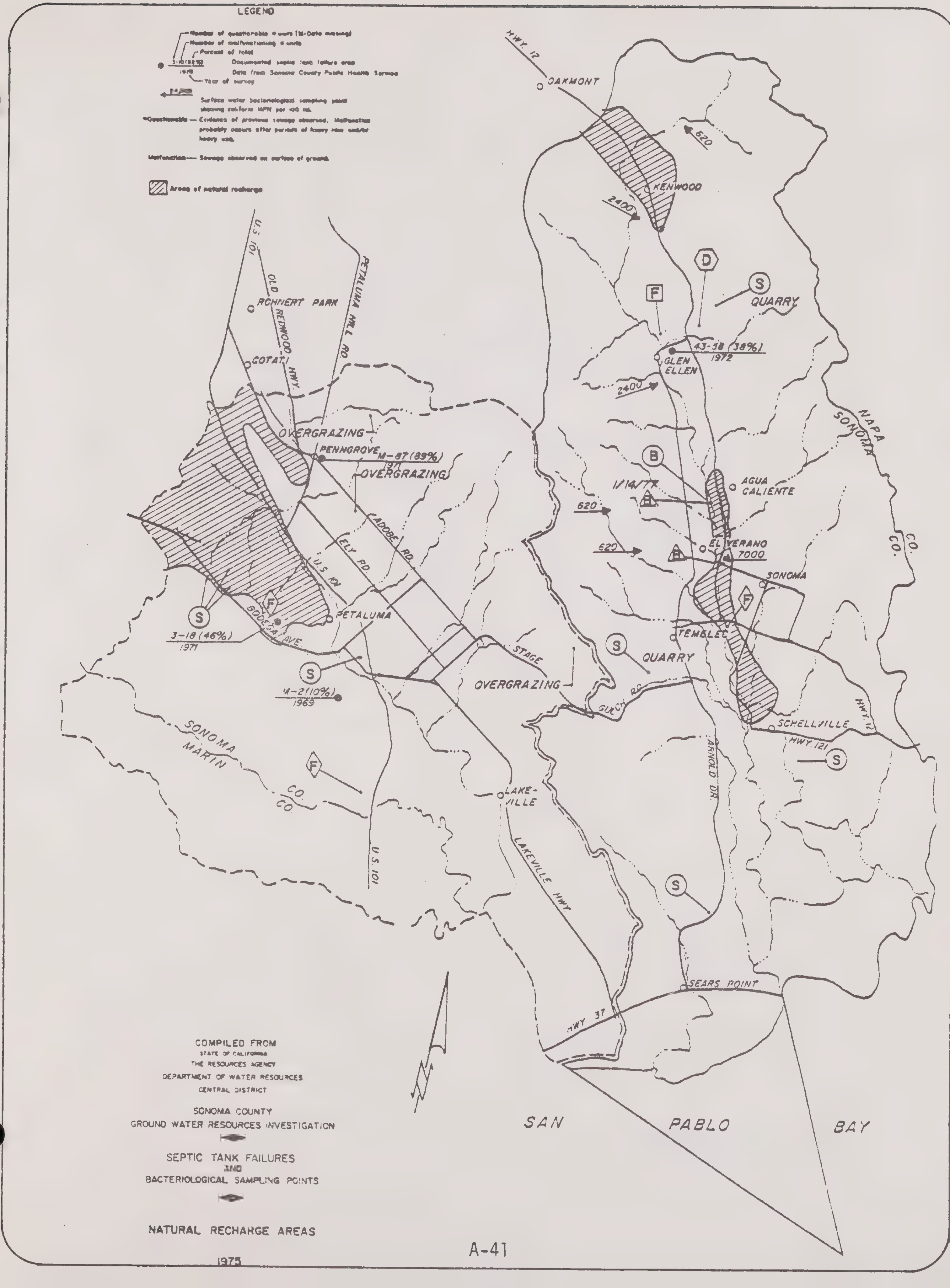
SUSPECTED EXISTING AND
POTENTIAL PROBLEMS MAP

INFORMATION ON THIS MAP PROVIDED BY
BY COUNTY OF SONOMA PUBLIC HEALTH
SERVICE JANUARY 1977

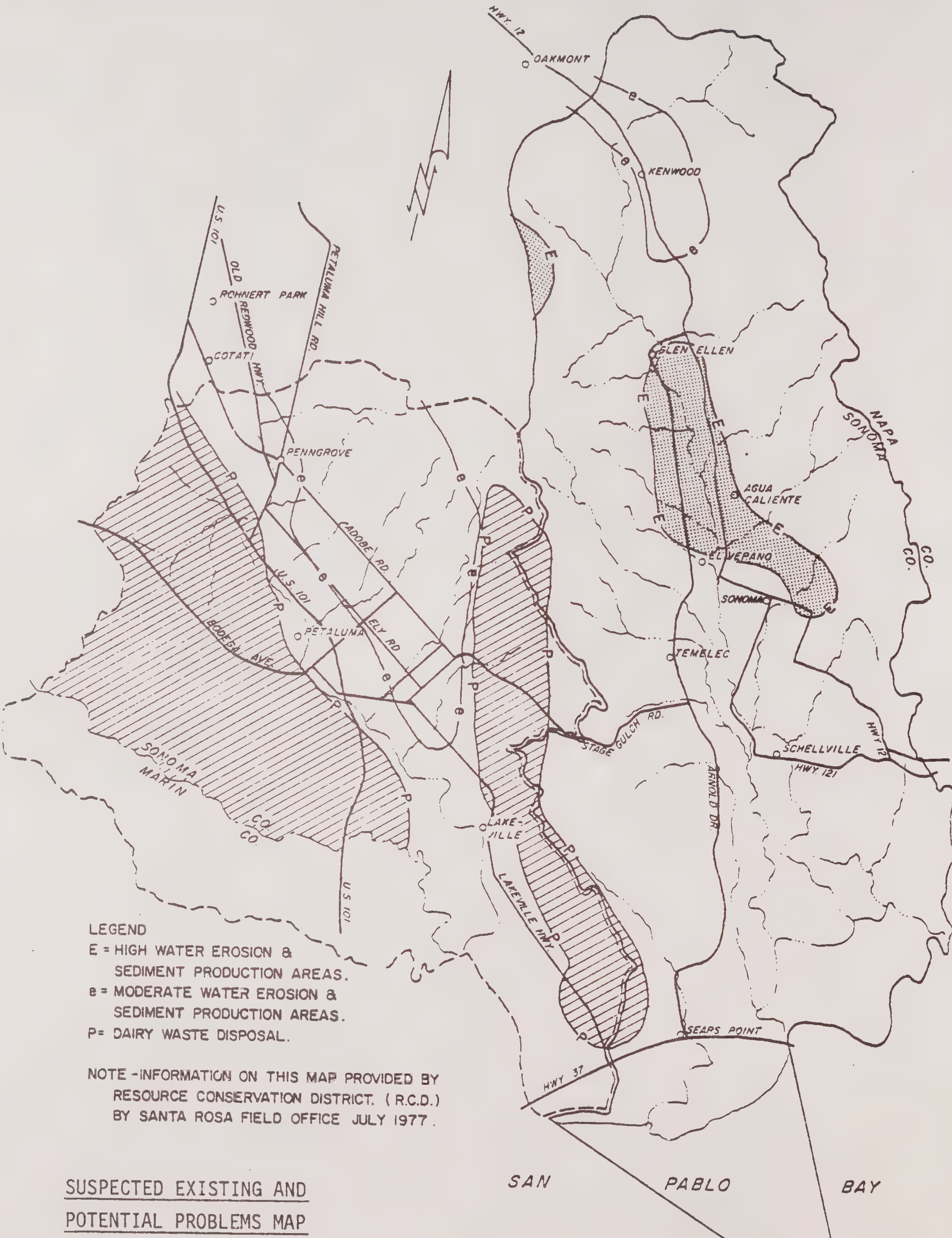


SUSPECTED EXISTING AND POTENTIAL PROBLEMS MAP

SITE MAP OF OBSERVATIONS MADE BY THE SONOMA COUNTY WATER AGENCY JUNE, 1977 UNLESS OTHERWISE DATED



LEGEND
Number of questionable units (16-Data missing)
Number of malfunctioning units
Percent of total
Documented septic tank failure area
Data from Sonoma County Public Health Service
Year of survey
Surface water bacteriological sampling point showing coliform MPN per 100 ml.
*Questionable — Evidence of previous sewage observed. Malfunction probably occurs after periods of heavy rain and/or heavy use.
Malfunction — Sewage observed on surface of ground.
Areas of natural recharge
HWY. 12
OAKMONT
620
KENWOOD
2400
D
S
QUARRY
F
43-58 (38%)
1972
GLEN ELLEN
2400
NAPA
SONOMA
CO.
CO.
B
AGUA CALIENTE
1/14/77
620
620
EL VERANO
7000
SONOMA
F
TEMELEC
S
QUARRY
OVERGRAZING
STAGE
GULCH RD.
SCHELLVILLE
HWY. 12
HWY. 121
S
ARNOLD DR.
U.S. 101
OLD REDWOOD HWY.
PETALUMA HILL RD.
ROHNERT PARK
COTATI
OVERGRAZING
PENNGROVE
M-87 (89%)
1971
OVERGRAZING
ADOBE RD.
ELY RD.
U.S. 101
S
F
3-18 (46%)
1971
BODEGA AVE.
PETALUMA
S
M-2 (10%)
1969
SONOMA
MARIN
CO.
CO.
F
LAKEVILLE
LAKEVILLE HWY.
U.S. 101
S
SEARS POINT
HWY 37
SAN PABLO BAY
N
COMPILED FROM
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
SONOMA COUNTY
GROUND WATER RESOURCES INVESTIGATION
SEPTIC TANK FAILURES
AND
BACTERIOLOGICAL SAMPLING POINTS
NATURAL RECHARGE AREAS
1975



SUSPECTED EXISTING AND POTENTIAL PROBLEMS MAP

AVAILABLE CONTROL MEASURE TECHNOLOGY

Woodward-Clyde Consultants prepared typical specifications on approximately 22 Control Measures for Urban Runoff for the Association of Bay Area Governments.

The U. S. Department of Agriculture, Soil Conservation Service (SCS) has specifications for approximately 48 Best Management Practices. The specifications along with about 13 others can be obtained through the local Resource Conservation Districts (RCD) for the Sonoma and Petaluma Basins.

The most immediate action should be education on use of Best Management Practice (BMP) in the rural areas. This would be expected to have the most impact in the short term avoiding most costly structural control measures. SCS and RCD specifications or guidelines should be made more readily available to property owners as part of the education effort.

See the following tables for a listing of the Woodward-Clyde and RCD control measures, including the action items of this plan which would implement those control measures.

TABLE NO. 23

URBAN RUNOFF

Control Measures from Woodward-Clyde Consultants

Control Measure	Description	SRMP Action Recommendation(s)	Comments
A-1	Implement street flushing		Uses water & is expensive to retrieve after flushing
A-2	Improve street sweeping	A-2.1 thru A-2.5	
A-3	Repair streets	A-3	
A-4	Control use of chemicals	S-1.8	
A-5	Control use of lots		
A-6	Control littering & solid waste practices	S-1.8	
A-7	Control contaminants from domestic animals	S-2.1, A-7	
A-8	Control the use of motor vehicles		Too rural for this measure
A-9	Control direct discharge of pollutants into storm sewers	A-9	
A-10	Eliminate cross connections with sanitary sewers		
A-12	Clean catchbasins	S-1.9	
A-13	Clean storm sewers & drainage channels	S-1.9, A-13, A-14	
B-1	Prevent roof drainage from entering storm sewers		
B-2	Detain precipitation on rooftops		New developments can also build detention basins
B-3	Direct runoff away from contaminated areas		
B-4	Retain runoff from areas which contain contaminants	S-1.9	

Control Measure	Description	SRMP Action Recommendation(s)	Comments
B-5	Impound runoff upstream	S-1.9	
B-8	Regrade disturbed areas	S-1.5, S-1.9	
B-10	Stabilize stream channels and banks	S-1.9	
B-12	Enhance natural surface retention & infiltration		
B-15	Control erosion from construction	S-1.5, S-1.6	
C-1	Treat & store runoff	C-1	

TABLE NO. 24

OPEN SPACE AND AGRICULTURAL RUNOFF

Control Measures from Resource Conservation Districts

Control Measure	Description	SRMP Action Recommendation(s)	Comments
1	Conservation Cropping system	S-2.1	
2	Conservation irrigation system	S-2.1	
3	Control construction erosion	S-1.5, S-1.6, S-2.7	
4	Control roadside erosion	S-2.7	
5	Critical area treatment	S-2.5, S-2.7	
6	Diversions and ditches	S-2.1, S-2.7	
7	Grade stabilizers	S-2.7	
8	Pasture and range management	A-7, S-2.7	
9	Runoff and sediment ponds	S-2.7	
10	Streambank & channel stabilization	B-10, S-2.7	
11	Waste management system	C-1, S-2.7	
12	Watershed, wildlife & recreation land improvement	S-2.1, S-2.7	
13	Woodland protection	S-2.1, S-2.7	

DATA BASE

The data base map is a reference for hydrologic and water quality related data. The information was gathered by many agencies for various purposes and may not necessarily contain data useful for surface runoff analysis. Each station symbol refers to a certain type of data. A list of data types are given in table form including information regarding the source, the quality and the time period over which the data was collected.

Station Symbol	Station
✶	Suspected problem areas
●	Streamflow Gauging Station
○	Inoperative Streamflow Gauging Station
□	Streamflow & Sediment Discharge Gauging Station
□	Inoperative Discharge Gauging Station
△	Water Quality Monitoring
◆	Rainfall Gauging Station - continuous
◇	Rainfall Gauging Station - other
✳	Evaporation Gauging Station
➡	Wasteload Outflow Location

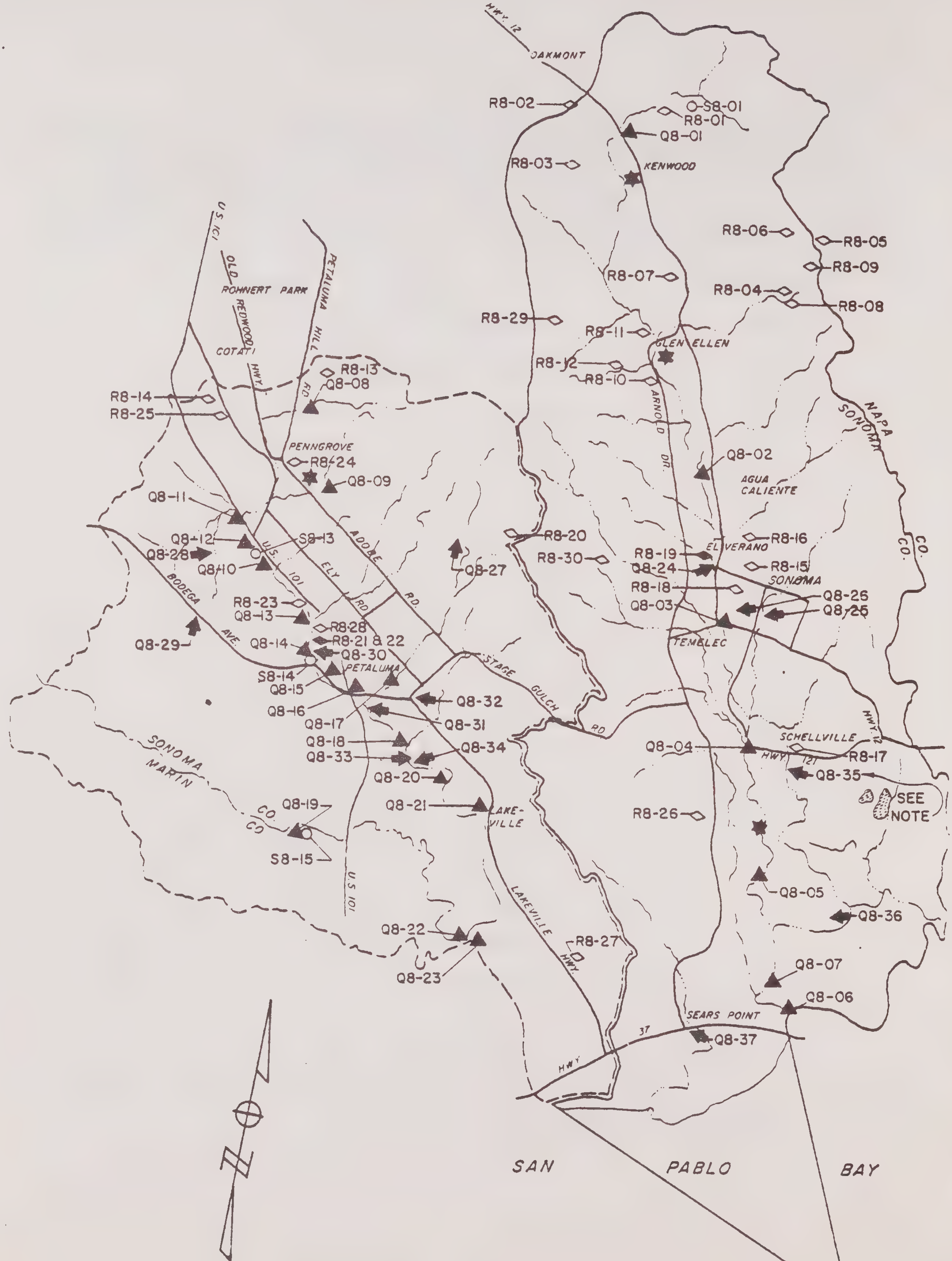
Each station symbol is identified by the following alphanumeric code:

(1) a letter
- S - denoting a streamflow gauging station
- Q - denoting a sediment & water quality gauging station
- R - denoting a rainfall gauging station
- E - denoting an evaporation gauging station

(2) a digit denoting county identification (8 corresponds to Sonoma County)

(3) a dash (-)

(4) two digits describing numerical sequence within a county of all gauging stations of a given type (S, Q, R, or E)



DATA BASE MAP

Waterway Stage & Discharge Data

Code	Agency/File	Monitoring Period	Location	Data
S8-01	USGS/No. 8400	1957-73	Sonoma Cr. near Kenwood	peak stage or discharge, low flow cross section, coefficients of roughness
S8-02	USGS/No. 4590	1948-1963	Petaluma River @ Petaluma	daily discharge continuous (data questionable)
S8-03	Son.Co.Water Ag.	1958-1965	Petaluma River @ D St., Petaluma	tide daily stage on Bay system
S8-04	USGS/No. 4593	1976-	San Antonio Cr. near Petaluma	discharge

Water Quality Data

Code	Agency/File	Monitoring Period	Location	Data
Q8-01	California DWR	5/29/74	Sonoma Cr. @ Hwy. 12 Bridge	standard minerals, misc. nutrients
Q8-02	USGS/No. 8500	1955-	Sonoma Cr. @ Agua Caliente	daily discharge, peak stage, flood frequency, coefficients of roughness, QW recurring measurement, sedimentation
Q8-03	California DWR	1974	Sonoma Cr. @ Leveroni Road	standard minerals, misc., nutrients
Q8-04	California DWR	1974	Sonoma Cr. @ Hwy. 121	standard minerals, misc., nutrients
Q8-05	California DWR	1974	Sonoma Cr. @ McGill	standard minerals, misc., nutrients
Q8-06	California DWR/ No. E3E 809.4 224.3	5/29/74	Sonoma Cr. @ Hwy. 37	standard minerals, misc., nutrients
Q8-07	California DWR	1974	Sonoma Cr. @ Camp Six	standard minerals, misc., nutrients
Q8-08	California DWR	1974	Lichau Cr. @ Railroad Avenue	standard minerals, misc., nutrients
Q8-09	California DWR	1974	Willowbrook Cr. @ Adobe Road	standard minerals, misc., nutrients
Q8-10	California DWR, State Water Res.Control Bd.	1974-75	Petaluma River @ Corona Road	standard minerals, misc., nutrients
Q8-11	California DWR, State Water Res.Control Bd.	1974-75	Willowbrook Cr. @ Stony Point Road	standard minerals, misc., nutrients
Q8-12	California DWR	1973	Petaluma River @ Old Redwood Hwy.No.	standard minerals, misc., nutrients
Q8-13	California DWR, State Water Res.Control Bd.	1973-75	Petaluma River @ W.Payran St., Pet.	standard minerals, misc., nutrients
Q8-14	California Regional Water Quality Control Board	1974	Petaluma River @ D St., Petaluma	standard minerals, misc., nutrients
Q8-15	California DWR, State Water Res.Control Bd.	1975	Petaluma River above Petaluma wastewater outfall	standard minerals, misc., nutrients

Water Quality Data - continued

Code	Agency/File	Monitoring Period	Location	Data
Q8-16	California DWR, State Water Res.Control Bd. -Reg.Water Quality Control Bd.	1973-75	Petaluma River @ McNear, Petaluma	standard minerals, misc., nutrients
Q8-17	California DWR	1974	Adobe Cr. @ Lakeville Rd.	standard minerals, misc., nutrients
Q8-18	California DWR, State Water Res.Control Bd.	1975	Petaluma River @ proposed Petaluma outfall	standard minerals, misc., nutrients
Q8-19	California DWR	1974	San Antonio Cr. above Hwy. 101	standard minerals, misc., nutrients
Q8-20	California Regional Water Quality Control Board	1974	Petaluma River Cut B, at Schultz Slough	standard minerals, misc., nutrients
Q8-21	California DWR, State Water Res.Control Bd. -Reg.Water Quality Control Bd.	1974-75	Petaluma River @ Lakeville Hwy.	standard minerals, misc., nutrients
Q8-22	California DWR, State Water Res.Control Bd. -Reg.Water Quality Control Bd.	1973-75	San Antonio Cr. near mouth	standard minerals, misc., nutrients
Q8-23	California DWR, State Water Res.Control Bd. -Reg.Water Quality Control Bd.	1974-75	Petaluma River below San Antonio Cr.	standard minerals, misc., nutrients
Q8-24	NPDES CA/0037800		Sonoma Valley C.S.D.	occasional overflows into Sonoma Cr. in wet weather from collection sys; 7 manholes overflow in heavy wet weather
Q8-25	"		"	"
Q8-26	"		"	"
Q8-27	NPDES CA/0038202		Petaluma (discharger)	22,000 GPD filter backwash & 60,000 gal. of alum. sludge twice a yr. to ditch trib. to So. fork of Washington Cr.

Water Quality Data - continued

Code	Agency/File	Monitoring Period	Location	Data
Q8-28	NPDES CA/0036218		Oscar Miller	chicken manure stored in dike area has been occasionally washed into adj. cr. due to dike failure
Q8-29	NPDES CA/0036200		Reichardt Duck Farm (discharger)	potential runoff from land area used for disposal of runoff, process waste, wash water & duck waste
Q8-30	NPDES CA/0037508		Petaluma (discharger)	overflows of unknown amt. of untreated waste from collection sys. during heavy rains occur @ 7 locations trib.to river
Q8-31	NPDES CA/0027855		Hlebakos & Sons (discharger)	storm water runoff from bulk fuel oil & storage facility to Petaluma River .5 mi. west of Hwy. 101
Q8-32	California Reg.Water Quality Control Bd.		Royal Tallow (discharger)	20,000 GPD of condensation & rinse water to aerated evaporation ponds
Q8-33	NPDES CA/0027898		Hein Bros. (discharger)	wet & dry weather discharge of wash water from rock quarry 8500 feet downstream of quarry
Q8-34	NPDES CA/0037508		Petaluma (discharger)	3.1 MGD secondary ADWF to Petaluma R.; industrial flow .3 MGD
Q8-35	NPDES CA/0037800		Sonoma Valley C.S.D.	1.9 MGD secondary ADWF to Schell Slough; wet weather flows in excess of 4 MGD bypassed untreated about 35 times yearly--ave. 1.3 MGD/ event

NOTE: future storage for reclamation of all flows from SVCSD T.P. see 1975-76 project reports no discharge total land disposal

Water Quality Data - continued

Code	Agency/File	Monitoring Period	Location	Data
Q8-36	Federal Government		Skaggs Island	discharge
Q8-37	California Regional Water Quality Control Bd.		Sears Point Raceway (discharger)	land application of stored & treated domestic sewage from raceway

Rainfall Data

Code	Agency	Monitoring Period	Sta.Name, No.& Elev.	Missing Years
R8-01	Sonoma Co.Water Agency	1957-66	Kenwood 1N	None
R8-02	"	1949-63 (daily)	Santa Rosa 7E F90-7965-09 490'	None
R8-03	"	1948-70 (daily)	Kenwood F90-4504-01 800'	None
R8-04	"	1957-68 (daily)	Glen Ellen 3 NE E20-3455-02	1958-60 daily, '61, '64 & '65 monthly, rest yearly
R8-05	"	1955-63 (monthly)	Glen Ellen 4 NE E20-3455-03	None
R8-06	"	1961-66	Wagers, M.D.	None
R8-07	"	1966-69 (daily)	McFarland	None
R8-08	U.S. Weather Bureau	1940	Oakville 4 SW 6354 1465'	None
R8-09	U.S. Weather Bureau	1963	Oakville 4SW #2 6356 1685'	None
R8-10	Sonoma Co.Water Agency	1953-present	Sonoma State Hospital E20-8351-03 440'	1966 & 67
R8-11	U.S. Weather Bureau		Glen Ellen E20-3455 100'	None
R8-12	Sonoma Co.Water Agency	1973-74 (daily)	Win Smith	None
R8-13	"	1930-62 (daily)	Penngrove 2N F90-6792-03 200'	None
R8-14	"	1967-69 (daily)	Sonoma State College #3 SSC #3	records very poor
R8-15	U.S.Weather Bureau	1952-present	Sonoma E20-8351 97'	None
R8-16	Sonoma Co.Water Agency	1964-68	Hoes, Harry	None
R8-17	"	1957-present	Sonoma 3SSE E20-8351-06 20'	None
R8-18	"	1929-60	Sonoma Streiff E20-8351-04 75'	None

Rainfall Data - continued

Code	Agency	Monitoring Period	Sta.Name, No.& Elev.	Missing Years
R8-19	Son.Co.Public Works	1956-present (hourly)	El Verano Corp. yard	None
R8-20	Son.Co. Water Agency	1953-61	Triangle G Ranch E20-9020-01 950'	None
R8-21	Son.Co.Water Agency copied from U.S.Dept. of Commerce Publication	1948-present (hourly)	Petaluma Fire Sta. #2 Petaluma 1N	'48-51 monthly total
R8-22	"	1951-present (daily)	Petaluma Fire Sta. #2 Petaluma 1N	None
R8-23	U.S. Weather Bureau	1943-present	Petaluma 1N E20-6829 30'	None
R8-24	Son.Co.Water Agency	1973-73 (3 mo.-new gage 9/22/76)	Penngrove Fire Station	None
R8-25	"	1959-65 (daily)	Penngrove 1NW	None
R8-26	"	1950-present	Sonoma 6S E20-8351-07 100'	None
R8-27	"	1929-present	Sleepy Hollow Dairy E20-8286 50'	None
R8-28	Corps of Eng., S.F.	1913-present	Petaluma Pendleton E20-6826-06 12'	None
R8-29	Son.Co. Water Agency	1947-present (daily)	Cundiff	1958-70 monthly only
R8-30	"	1948-present	Sonoma 4W E20-8351-08 500'	1971 & 1972
R8-31	"	1956-61 (daily)	Sonoma 2N E20-8351-05 850'	None

G L O S S A R Y

ABAG	The Association of Bay Area Governments
Algae	Any of numerous chlorophyll-containing plants of the phylum thallophyta that grow in either sea water or fresh water; seaweeds and pond scum are algae
Ambient	Completely surrounding or encompassing
Base Flow	Stream discharge derived from groundwater sources. Sometimes considered to include flows from regulated lakes or reservoirs. Fluctuates much less than storm runoff.
BOD	The abbreviation and most commonly used name for biochemical oxygen demand. This is the quantity of oxygen used in the biochemical oxidation (decay) of organic matter in a specified time and under specified conditions. In general terms, a high BOD suggests a water burdened with organic wastes and thus likely to be deficient in oxygen and inhospitable for most plant and animal life.
Calibration	The procedure of assigning values to the uncertain or unknown parameters in simulation model and adjusting them until model predictions correspond acceptably with observed prototype behavior.
Catch Basin	A chamber or well, usually built at the curb line of a street, for the admission of surface water to a sewer or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.
Coliforms	A large and varied group of bacteria. Fecal coliform bacteria, commonly found in the intestines and feces of warm blooded animals (including man), apparently does not cause disease, but its presence in water suggests that disease causing organisms may be present. Colimforms are used as indicators of pollution because they are abundant and their presense is fairly easy to detect.
Computer Modeling	The simulation of certain physical events via a mathematical model. As the calculations involved are usually numerous and lengthy, a computer is used to expedite the process.
Concentration	The quantity of a given constituent in a unit volume or weight of water.
Contamination	The introduction into water of pathogenic organisms that render it unfit for human consumption or domestic purposes.
Control Measure	Any action that will reduce or hold steady the quantity of one or more pollutants being discharged into a receiving body of water.
Dissolved Oxygen	The concentration of dissolved oxygen in water (measured in mg/l). Non-living organic matter and various chemicals react with oxygen in water, depleting its concentration and causing stress (from lack of oxygen) on fish and other aquatic life. DO saturation levels are greater in cold water than in warm, and at sea level (high atmospheric pressure) than at high altitudes (low atmospheric pressure).

Dissolved Solids	The total amount of dissolved material, organic and inorganic, contained in solution in water or wastes.
Drainage Basin	A geographical area or region which is so sloped and contoured that surface runoff from streams and other natural watercourses is carried away in a single drainage system by gravity to a common outlet or outlets; also referred to as a watershed or drainage area.
Dry Weather Flow	The combination of sanitary sewage, and industrial and commercial wastes normally found in the sanitary sewers during the dry weather season of the year. Also, that combination of flow in streams during dry seasons.
Effluent	The liquid discharged by a sewage treatment plant or industry.
EMP	The Environmental Management Plan for the San Francisco Bay Area.
EPA	The Environmental Protection Agency.
Erosion	The washing away of soil by the action of surface runoff.
Eutrophication	The prgressive enrichment of surface waters particularly non-flowing bodies of water such as lakes and ponds with dissolved nutrients, such as phosphorous and nitrogen compounds, which accelerate the growth of algae and higher forms of plant life and result in the utilization of the useable oxygen content of the waters at the expense of other aquatic life forms.
Fecal Coliform	Fecal coliform are indicators of human and animal pollution and are expressed as numbers of bacteria per volume of sample.
First Flush	The condition, often occurring in torm sewer discharges and combined sewer overflows, in which a disproportionately high pollution load is carried in the first portion of the discharge or overflow.
Floatables	Litter, debris, oil and grease.
Groundwater	Subsurface water that occupies the pore spaces of the rock in which it is located.
Groundwater Recharge Area	The portion of a land surface through which the groundwater receives its replenishment by the percolation of water through the soil and intermediate zone.
Heavy Metals	Elements in water that can be precipitated by hydrogen sulfide in acid solution, e.g., lead, silver, mercury and copper. Considered as serious pollutants.
Hydrograph	A graph of the flow in a stream during the time period of a rainstorm.
Hyetograph	A graph of rainfall intensity versus time during the period of a storm.
Implementation	Actually putting a control measure into effect as opposed to preparing a control measure to be put into effect.
Land Use Category	The specific classification of a given piece of land based on its predominant use, e.g., residential, commercial, etc.

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Ambient	Completely surrounding or encompassing
Base Flow	Stream discharge derived from groundwater sources. Sometimes considered to include flows from regulated lakes or reservoirs. Fluctuates much less than storm runoff.
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Calibration	The procedure of assigning values to the uncertain or unknown parameters in simulation model and adjusting them until model predictions correspond acceptably with observed prototype behavior.
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Computer Modeling	The simulation of certain physical events via a mathematical model. As the calculations involved are usually numerous and lengthy, a computer is used to expedite the process.
Concentration	The quantity of a given constituent in a unit volume or weight of water.
Contamination	The introduction into water of pathogenic organisms that render it unfit for human consumption or domestic purposes.
Control Measure	Any action that will reduce or hold steady the quantity of one or more pollutants being discharged into a receiving body of water.
Dissolved Oxygen	The concentration of dissolved oxygen in water (measured in mg/l). Non-living organic matter and various chemicals react with oxygen in water, depleting its concentration and causing stress (from lack of oxygen) on fish and other aquatic life. DO saturation levels are greater in cold water than in warm, and at sea level (high atmospheric pressure) than at high altitudes (low atmospheric pressure).

Point Source Pollution	"The term 'point source' means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation vessel or other floating craft, from which pollutants are or may be discharged." (Act, Section 502(14)).
Pollutant	"The term 'pollutant' means dredged spoil, solid waste incinerator residue, sewage, garbage, sewage sludge, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water." (Act, Section 502(6)). Refers to any of several constituents found in water and deemed to be harmful if present in large enough quantities. Referring to something as a pollutant generally refers to its potential and does not necessarily imply an existing problem. (See Pollution and Water Quality Parameter).
Pollutant Loading	An estimation of the amount of a given pollutant washing off a land surface of a given type, usually after a rainfall.
Pollution	The loss or impairment of a beneficial use of a body of water due to a change in the level of one or more water quality parameters.
Pollutograph	A graph of pollutant concentration as a function of time during a rainfall/runoff event.
Primary Treatment	A series of mechanical treatment processes, including screening, skimming and sedimentation, that remove most of the floating and suspended solids found in sewage, but that have a limited effect on colloidal and dissolved material.
Public Law 92-500	The federal law which required the preparation of the EMP. Also known as the Federal Water Pollution Control Act Amendments of 1972.
Reach	A stream segment, comprised of several elements with homogeneous hydraulic properties.
Receiving Water	A natural watercourse, lake or ocean into which treated or untreated wastewater is discharged.
Recession Limb	The falling portion of a hydrograph in which water is being withdrawn from storage in the drainage area.
Recurrence Interval	A term referring to the frequency and intensity of storm. A storm with a 100-year recurrence interval has a 1% chance of occurring in any given year.
Residual Wastes	Those solid, liquid, or sludge substances from an's activities in the urban, agricultural, mining and industrial environment which are not discharged to water after collection and necessary treatment.
Retention Storage	The temporary storage of stormwater runoff in a device such as a pond or basin.

Runoff	That portion of the precipitation on a drainage area that is discharged from the area in stream channels.
Runoff Factor	The percentage of rainfall that actually runs off the land and into a drainage system.
Sampling	The physical process of obtaining Sample Sets.
Sample Set	A group of water samples to be analyzed for several water quality parameters. (See Analysis)
SCWA	Sonoma County Water Agency
Secondary Treatment	A series of biochemical (trickling filters or activated sludge), chemical (coagulation), and/or mechanical (sedimentation) treatment processes, that remove, oxidize, or stabilize non-settleable, colloidal and dissolved organic materials found in sewage, following primary treatment.
Sediment	Visible fine organic or earthen particles suspended in water.
Sedimentation	The process of subsidence and deposition of suspended matter carried by water, sewage, or other liquids, by gravity. It is usually accomplished by reducing the velocity of the liquid below the point where it can transport the suspended material.
Silt	Fine particals of soil and rock usually less than 1/20 millimeter in diameter.
SRQC	Surface Runoff Quality Committee
SRMP	The Surface Runoff Management Plan.
Subarea	A watershed of a small stream or creek or a portion thereof; the smallest unit of analysis in water modeling, defined using the criteria of homogeneous slope, homogeneous land use (hydraulic roughness), and uniform width, measured perpendicular to the direction of flow.
Surface Runoff	Rainwater which flows over the land surface and into a drainage system rather than soaking into the ground or evaporating.
Suspended Solids	Particulate matter held in suspension (as opposed to dissolved) in water and readily removable by filtering.
SWMM	The Stormwater Management Model.
TDS	Total Dissolved Solids. The dissolved salt loading in surface and subsurface waters.
Tertiary Treatment	Any sewage purification process that has the capability to remove over 98 percent of the pollutants from sewage, following secondary treatment.

Total Nitrogen	The total amount of the element nitrogen, a principal nutrient required for biological growth, in all its chemical forms. Four forms of nitrogen are of main interest in water quality management. These are ammonia, nitrite, nitrate, and various compounds of organically-bound nitrogen. These forms are all normalized and expressed as total nitrogen.
Total Phosphorus	The total amount of the element phosphorus, a principal nutrient required for biological growth, in all its chemical forms. Phosphorus may exist in wastewater as ortho, poly, and organic phosphorus.
Total Suspended Solids	All particulate matter in a water sample that is removable by laboratory filtering.
"201"	Refers to Section 201 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). Section 201 calls for detailed planning for the wastewater treatment facilities needed to achieve the goals of the Act.
"208"	Refers to Section 208 of the Federal Water Pollution Control Act Amendment of 1972 (PL 92-500). Section 208 provides for the designation of areawide waste treatment management planning agencies for the purpose of "developing effective areawide waste treatment management plans" for areas that, because of "urban-industrial concentrations" or other factors, have "substantial water quality control problems." The areawide approach is aimed at integrating controls over municipal and industrial wastewater, storm sewer runoff, non-point source pollutants and land use.
Water Quality Parameter	A general term referring to any one of the many properties or constituents of a body of water that are commonly measured as indicators of the quality of the water, e.g., temperature, dissolved oxygen, BOD, suspended solids.
Watershed	A region or area bounded peripherally by a drainage divide and draining ultimately to a particular watercourse or body of water.
Wet Weather Flow	A combination of dry weather flows, infiltration, and inflow which occurs as a result of rainstorms.

BIBLIOGRAPHY

Army, Secretary of the, LETTER RE. SONOMA CREEK (referred to Committee on Public Works), 6/28/65

Association of Bay Area Governments, INTEGRATED LAND USE/AIR QUALITY/WATER QUALITY CONTROL STUDY FOR SONOMA COUNTY, 1976

California, State of, Water Quality Control Board, A POLLUTION STUDY OF PETALUMA CREEK, 1951

------- STATUS OF WATER POLLUTION CONTROL IN SONOMA COUNTY, 2/64

------- WATER QUALITY CONTROL POLICY FOR SONOMA AND MARIN COUNTY COASTAL WATERS, 1967

------- WATER QUALITY CONTROL PLAN SAN FRANCISCO BAY BASIN, 7/75

California, State of, Department of Natural Resources, Division of Soil Conservation, RECONNAISSANCE STUDY OF THE UPPER SONOMA CREEK WATERSHED, 1959

California, State of, Department of Water Resources WATER QUALITY INVESTIGATIONS OF WINERY WASTE DISPOSAL ON GROUND WATER

Davis, Del Assoc., Inc., DRAFT EIR, PROPOSED 165 UNIT CONDOMINIUM, 8/74

------- DRAFT EIR, CARMODY 7-11, 8/75

------- DRAFT EIR PROPOSED QUANTAS PLANNED DEVELOPMENT, MILLMEISTER PROPERTY, 8/75

------- DRAFT EIR, PLANNED UNIT DEVELOPMENT, 9/75

Environmental Impact Planning Corporation, ENVIRONMENTAL ASSESSMENT, EAST WASHINGTON STREET IMPROVEMENT PROJECT, 6/75

Hall and Goodhue Community Design Group, The, GENERAL PLAN, CITY OF SONOMA, CA, 1974

Hill, Elgar, PETALUMA FARMS, 5/75

------- ENVIRONMENTAL ANALYSIS & PLANNING, MONELLI RANCH, 9/76

Laidlaw, Don & Assoc., DRAFT EIR PETALUMA MARINA, 6/76

Livingston & Blayney, PETALUMA AREA GENERAL PLAN, 1962

Montgomery, James, Consulting Engineers, EIR WASTEWATER MANAGEMENT FACILITIES FOR PENNGROVE, SONOMA COUNTY, CA, 6/75

Nute (J. Warren), Inc., NORTH MARIN-SOUTH SONOMA REGIONAL WATER QUALITY MANAGEMENT PROGRAM, 1972

Petaluma, City of, CITY OF PETALUMA ENVIRONMENTAL DESIGN PLANS, 3/72

------- Public Works Department, PROPOSED PETALUMA RIVER PROJECT, 5/59

Petaluma Community Development Commission, EIR PETALUMA CBD REDEVELOPMENT PLAN, 1976

Shepard Associates, PORT SONOMA/SHELLMAKER DRAFT, 1974

Solano-Napa River and Harbor Association, FEASIBILITY REPORT, NAPA RIVER-SONOMA CREEK CHANNEL DEVELOPMENT FOR NAVIGATION AND INDUSTRIALIZATION, (prepared for presentation to the U. S. Army Corps of Engineers), 6/63

Sonoma County Flood Control & Water Conservation District, PRELIMINARY FLOOD CONTROL REPORT FOR THE SONOMA CREEK WATERSHED, 5/14/56

------- PUBLIC HEARING ON PROPOSED PROJECT FOR FLOOD CONTROL & RECREATION FACILITIES ON SONOMA CREEK, Veterans Memorial Building, Sonoma, CA, Judy Gentry, Official Shorthand Reporter, 9/25/63

------- ENGINEER'S REPORT FOR ESTABLISHMENT OF ZONE NO. 3A, VALLEY OF THE MOON ZONE, 11/66

Sonoma County Planning Department, SPECIFIC PLAN, SOUTH SONOMA VALLEY STUDY DISTRICT, AREA ONE, 10/75

------- SPECIFIC PLAN, SOUTH SONOMA VALLEY STUDY DISTRICT AREAS 1 AND 2, 10/75

Sonoma County Road Department, PRELIMINARY ENVIRONMENTAL EVALUATION, 11/15/73

Sonoma County Tidelands Harbor & Beach Commission, PROPOSED PETALUMA RIVER PROJECT MODIFICATION, 3/64

Sonoma County Water Agency, FLOOD CONTROL DESIGN CRITERIA, Revised April 1973

Sonoma Valley Soil Conservation District, AN INVENTORY OF WATERSHED RESOURCES, 1965

------- COMMUNITY WATERSHED DEVELOPMENT PLAN, SONOMA CREEK WATERSHED, 1968

Uniconsult, Inc. TECHNICAL WATERSHED FACTS, SONOMA CREEK WATERSHED (for Sonoma Valley Soil Conservation District), 9/65

------- SONOMA VALLEY COMMUNITY WATERSHED PROJECTS, PHASE II INTERIM REPORT (for Sonoma Valley Soil Conservation District), 11/66

U. S. Department of Agriculture, Forest Service and Soil Conservation Service, SOIL SURVEY, SONOMA COUNTY, 5/72

U. S. Department of the Army, Corps of Engineers, PROGRESS REPORT, FLOOD PROTECTION FOR SONOMA CREEK BASIN, CA, 9/63

------- REVIEW REPORT FOR FLOOD CONTROL & ALLIED PURPOSES, SONOMA CREEK BASIN, 11/63

------- SONOMA CREEK CHANNEL IMPROVEMENT, ENVIRONMENTAL STATEMENT, 8/70

------- REPORT OF TESTS FOR POLLUTANTS IN CORE AND WATER SAMPLES, WEST RICHMOND CHANNEL, SONOMA CREEK, NAPA RIVER, 1971

------- WORKING PAPER, ENVIRONMENTAL EVALUATION SONOMA CREEK FLOOD CONTROL PROJECT, SONOMA COUNTY, CA, 4/72

------- DRAFT REPORT ON SONOMA CREEK, CA, 2/74

BIBLIOGRAPHY (continued)

U. S. Department of the Army, Corps of Engineers, <u>LETTER</u>, 2/14/74

------- <u>MAINTENANCE DREDGING PETALUMA RIVER, SONOMA & MARIN COUNTY DRAFT EIS</u>, 9/74

------- <u>ENVIRONMENTAL STATEMENT MAINTENANCE DREDGING, PETALUMA RIVER</u>, 8/75

U. S. Fish & Wildlife Service, <u>REFUGE LAND ACQUISITION REPORT</u>, 7/74

U. S. Geological Survey, <u>GEOLOGY AND GROUND WATER IN NAPA AND SONOMA VALLEYS, NAPA AND SONOMA COUNTIES</u> (Water Supply Paper No. 1495)

------- <u>GEOLOGY & GROUND WATER IN THE SANTA ROSA AND PETALUMA VALLEY AREAS, SONOMA COUNTY</u>, 1958

Warren, Donald R. Co., Engineers, <u>FLOOD CONTROL REPORT FOR THE LOWER SONOMA VALLEY</u>, 1/46